Railway Engineering and Maintenance

One Piece

The FAIR RAIL ANTI CREEPER

CHICAGO THE P. & M. CO. NEW YORK

MONTREAL LONDON PARIS CALCUTTA SYDNEY

HY-CROME
Spring Washers

UNIFORM BOLT TENSION

BOLTED joint security dictates the necessity for a spring washer which will insure the uniform bolt tension which Hy-Crome offers in unstinted measure. Ability to unfailingly maintain this tension against the incessant hammer blows from heavy traffic has led to the priority of choice of Hy-Crome by many of our leading roads.

"Millions in Service—Servicing Millions of Joints"

THE RELIANCE MFG. COMPANY
MASSILLON, OHIO

NEW YORK CLEVELAND DETROIT CHICAGO ST. LOUIS SAN FRANCISCO
N. S. Kenney, Munsey Bldg., Baltimore, Md. Engineering Materials, Ltd., McGill Bldg., Montreal, Quebec, Canada

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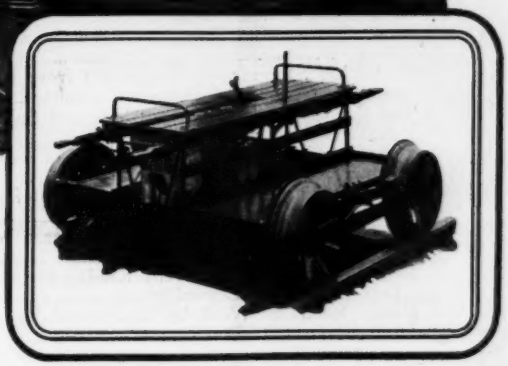
LOWER COST PER CAR PER MILE



Where a modern railroad cuts the Chinese wall

MODERN railroad transportation is overcoming Chinese superstition just as surely as the great wall is crumbling. American standards of construction and equipment have had an important influence on the development of the leading Chinese roads. In some instances, American equipment has been adopted without change, as in the case of Mudge Motor Cars.

Extreme simplicity and absolute dependability have made these husky thoroughbreds favorites in China as they are all over the world—wherever there's a railroad track.

Mudge & Company

Manufacturers—Railroad Equipment
Railway Exchange Building, Chicago

A MOTOR CAR FOR EVERY SERVICE

CONTENTS

Volume 22 November, 1926 Number 11

What Is Being Done in the Way of Track Maintenance in Winter?....446
Fewer Ties Treated in 1926....451
Bureau of Safety Reports on Several Serious Derailments....451
How the Railway Lines of Cuba Are Maintained; Ben B. Shaw....453
Bridge and Building Association Meets in the South....455

Editorials....443
The Side-Load Car Is Not Obsolete....443
A Valuable Service....443
A Challenge....443
A Bad Start....444
The Requirements Are Exacting....444
The First Winter Storm....444
Contrasting Attitude Toward Conventions....444
Letters to the Editor....445
Effect of Modern Locomotives on the Lengths of Turnouts....445
New Books....445
Practical Track Work....445
Bridge and Building Association Meets in the South....455
R. H. Aishton on Service....456
Organization of Painting....456
T. H. Carrow Addresses Convention on Accidents....457
Protecting Structures Over Tracks from Locomotive Gases; Report of Committee....458
The Use of Motor Cars by Bridge and Building Gangs; Report of Committee....460
Methods of Repairing Disintegrated or Poor Concrete; Report of Committee....462
The Framing of Bridge Timbers Before Treatment; Earl Stimson....464
Pumping Equipment for Various Classes of Service; Report of Committee....466
Relative Merits of Different Kinds of Roofing; Report of Committee....467
Public Relations Work by Bridge and Building Forces; W. D. Faucette....469
The Use of Compressed Air in Bridge and Building Work; Report of Committee....470
The Application of Protective Coatings to Structural Steel; Report of Committee....472
The Use of Creosoted Timber; Report of Committee....473
Supply Manufacturers Present Large Exhibit....474
What's the Answer....476
Nicked Rails Are Dangerous....476
Insulation for Roundhouse Roofs....477
Effect of Oiling Roadbed on the Efficiency of the Ballast....477
The Maintenance of Crossing Plank....478
The Interval Between First and Second Lifts for Ballasting Under Traffic....478
Field Tests for Concrete Gravel....479
Type of Pile Driver for Maintenance Work....479
Tools for Water Supply Repair Men....480
A Stimulus for the Safe Handling of Motor Cars....480
Getting the Manufacturers' Help....481
Fairmont Introduces Motor Car Top....481
The Syntron Electric Tie Tamper....481
A New Machine for Cleaning Ballast....482
The Material Market....483
Railway News Briefly Told....484
Personal Mention....485
Construction News....488
Supply Trade News....490

204

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

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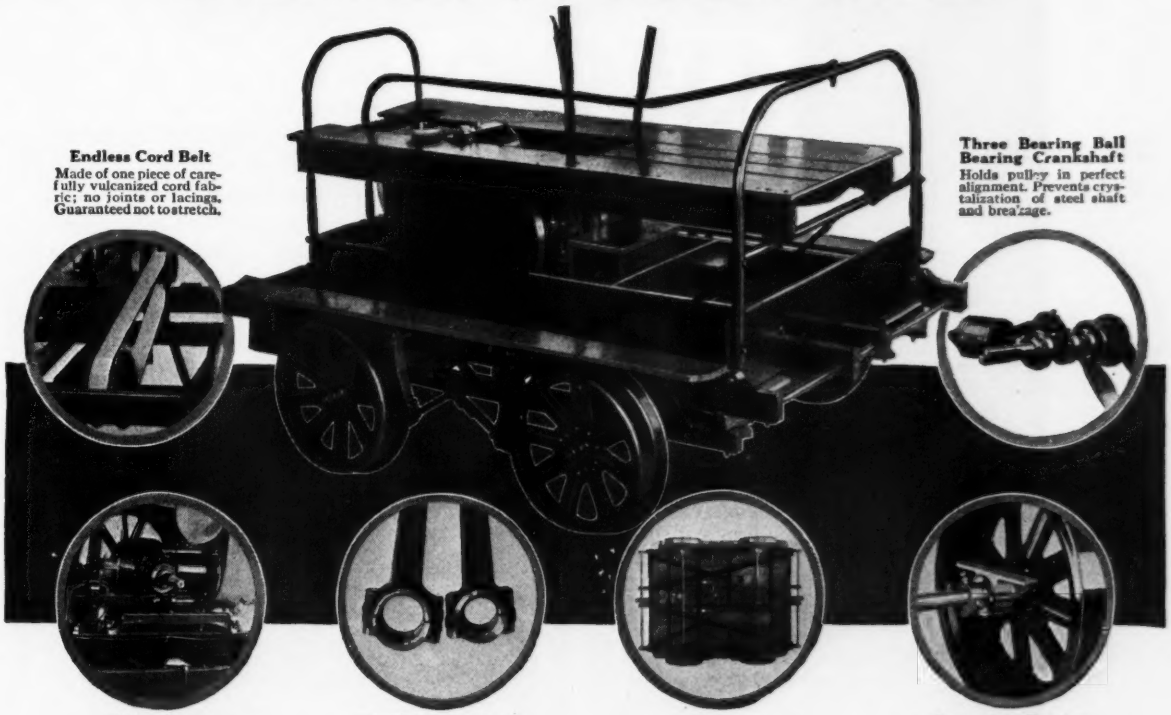
Fairmont
RAILWAY MOTOR CARS



Endless Cord Belt
Made of one piece of carefully vulcanized cord fabric; no joints or lacings. Guaranteed not to stretch.

Three Bearing Ball Bearing Crankshaft
Holds pulley in perfect alignment. Prevents crystalization of steel shaft and breakage.

Sliding Base
Extra large ways. Automatic spring take-up for wear. Shock-absorbing lever link eliminates vibration.

Crank Pin Bearing
Extra large, increased from—1 9-16" x 1¾" to 2"x2".

Frame
Of selected white oak well braced in all directions.

Bower Axle Bearing
Absorbs radial and side sway thrusts eliminating all wear from wheel hub, axle and bearing casings.

STRONGER THROUGHOUT

Where wear is greatest Fairmont Motor Cars are made extra strong. Frames are constructed of selected white oak reinforced and well braced in all directions with steel. The belt is the famous new Endless Cord type which eliminates weakening joints and lacings and is *guaranteed not to stretch.* The crankshaft is held in perfect alignment and protected from wear by three over-size ball bearings, of highest quality steel. Throughout Fairmont cars are ruggedly built to stand many years of severe service at minimum maintenance cost. Railroads appreciate this greater endurance as is evidenced by the fact that over half of the section cars in use are FAIRMONTS.

Performance on the Job Counts

Fairmont Railway Motors, Inc.
Fairmont, Minnesota

District Sales Offices

New York Chicago St. Louis
San Francisco Washington, D. C.
Winnipeg, Can.

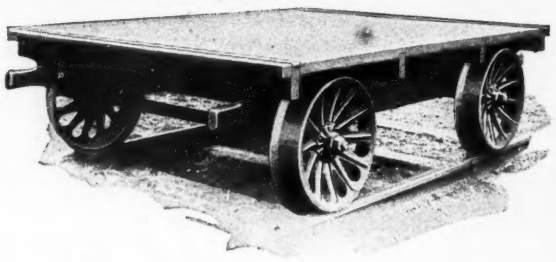
FAIRMONT RAILWAY MOTOR CARS

M19	M14	*S2 *M2 *A2
Inspection Car for one man to four men.	Light Section Car for gangs up to six men.	Section Cars. Seating capacities from eight to twelve men. Pulling capacities up to fifty men.

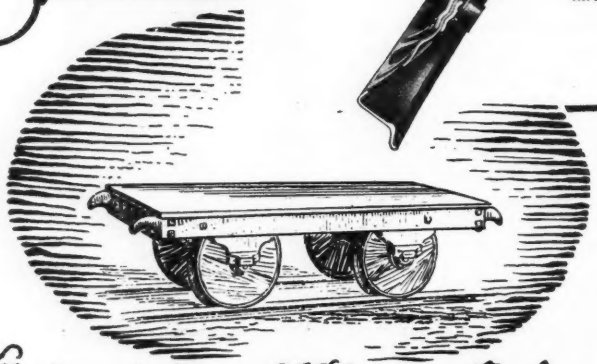
*ST2 — MT2 — and AT2 are corresponding models equipped with 2 speed transmission for extra heavy pulling.

Install Q AND C ELEC
SNOW
Q & C Electric Snow Melters are always ready. They can be placed under the rails in the fall and are ready for service at any minute and for any length of time until removed in the spring. Labor is practically eliminated, especially when needed during a storm and can be released for use at other points. There is nothing to get out of order. Each element is enclosed in a special non-corrosive container which is absolutely waterproof, and will operate successfully under all conditions. Operating expenses are involved only when the current is turned on during a snow storm. There are no pipes to freeze or gas to be blown out. It is a modern invention designed to keep switches open through the worst snow storms and insure safety to life and limb.
and
eclipse Storm Trou

MELTERS
Now
Right now—this month—is the time to make preparations for the coming winter. Be prepared when the snow flies and don't have clogged switches interfering with your schedules.
Preparedness now will save costly delays later on and will insure early deliveries on your requirements — a condition that may not be possible later on.
We will be glad to furnish complete information covering blue prints, installations and prices upon request.
THE Q and C COMPANY
90 West St., New York
Chicago St. Louis
and Hand Sweeping
at switches



The cross section of Kalamazoo Steel Wheel shows how the metal is thickened at the throat of the flange—practically doubling the life of the wheel.



Before the Time of Kalamazoo Products

No. 2 OF A SERIES

A few decades ago anything which approximated roundness was called a wheel and was used as such. Push cars and hand cars bumped along on "wheels" that reminded you of the wheels of a Mexican ox cart—two solid wooden blocks bound together with a metal tire.

The pressed steel wheel was considered a vast improvement, but the Kalamazoo patented rolling or spinning process, by thickening the metal at the flange-throat, produces a wheel with 60 to 100 per cent longer life than the ordinary steel wheel—also a wheel more truly round. **Hubs guaranteed not to work loose.**

Wood Center Wheels

The Kalamazoo wood center wheel retains all the features of the steel wheels—including the reinforced flange-throat—thus assuring you of a wood center wheel of longer life and more enduring service.

Kalamazoo Means Service to You

The Kalamazoo Line

What It Means to You

The name KALAMAZOO on any wheel is a guarantee of quality. Our factory, through patented processes, has developed Steel Wheels and Wood Center Wheels of the longest life and most perfect roundness made today. Kalamazoo wheels mean a reduction of 60 to 100 per cent of your wheel replacement costs.

We manufacture also a complete line of Motor Cars, Hand Cars, Push Cars, Rail Cars, Velocipede Cars and Trailers, Kalamazoo Electric Crossing Gates, Moore Track Drills, Gauges and Levels, Wood Cattle Guards, Steel Cattle Guards—in fact a complete line of maintenance of way equipment.

KALAMAZOO RAILWAY SUPPLY CO.

Kalamazoo, Michigan, U. S. A.

Established 1884

New York Chicago St. Louis St. Paul New Orleans Denver Spokane
Seattle Portland, Ore. Havana London Mexico City Johannesburg
Vancouver Winnipeg Montreal

67 Different vital parts made of alloy steels

One of the most progressive railroad executives in America is now making 67 different vital parts of his locomotives of alloy steels. And no man in America knows steel better. This ought to be interesting information to every railroad executive and our metallurgists will be glad to discuss the matter at any time.

INTERSTATE IRON & STEEL CO.
104 South Michigan Avenue
CHICAGO

Open Hearth Alloy Steel Ingots, Billets, Bars
Wire Rods, Wire, Nails, Rivets and Cut Tacks
Iron Bars and Railroad Tie Plates

Interstate Steels

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This Label

on a Track Tool
is evidence of extra
quality and guarantee of
extra service

Look for the Label

The Warren Tool & Forge Co., 243 Griswold St., Warren, O.

THE DEVIL TOOLS

ELECTRIC TIE TAMPING

An Economical and Efficient Method of Tamping all Kinds of Ballast

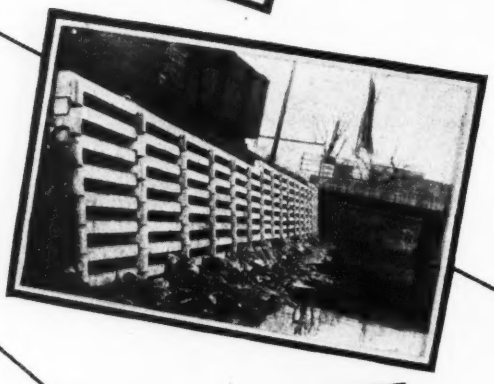
The light compact power unit supplying current for operating Jackson Electric Tie Tampers is moved from one position to another along the track in ten minutes, the average distance being 550 ft. No cribbing nor special foundation is required. The plant is placed upon the ground and occupies a space of 18 x 33 inches—Ample room on fills or cuts for these plants.

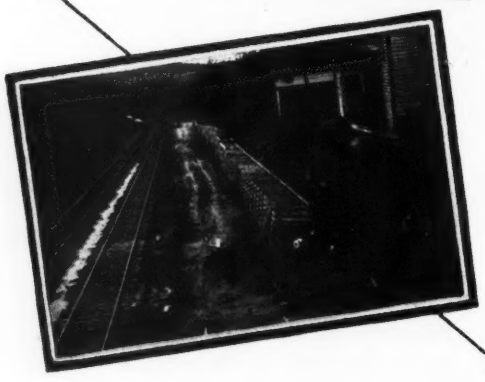
By cutting down the number of tamping units, the Electric Tamper equipment suitable for large extra gangs is light enough to be handled easily by the regular maintenance forces of 6 to 10 men with equal efficiency.

Six years use of Jackson Electric Tampers by our largest Railway systems has fully demonstrated the ability of these plants to stay on the job continuously and give excellent satisfacttion in the hands of ordinary track labor.

ELECTRIC TAMPER & EQUIPMENT CO.

RAILWAY EXCHANGE **CHICAGO, ILLINOIS**





Straight as a String

Sight down any Massey Concrete Cribbing Wall that has been properly laid. You will find it in line. Massey Cribbing is as stable and permanent as a monolithic wall. Don't confuse a Massey Cribbing Wall with an old tie crib or other makeshift for holding an embankment. It's a new type of permanent wall construction.

Massey Cribbing Units are built in the same plants and under the same high standards of workmanship and supervision as Massey Concrete Culvert Pipe and other precast concrete products that have been used by leading roads for years. The simplicity and correctness of design of the Massey Units have been demonstrated in service in scores of installations. Such walls are no longer an experiment.

Our engineers have had experience with cribbing walls all over the country and under widely varying conditions. This experience is at your command whenever you are considering a retaining wall problem. May we be permitted to serve you?

MASSEY

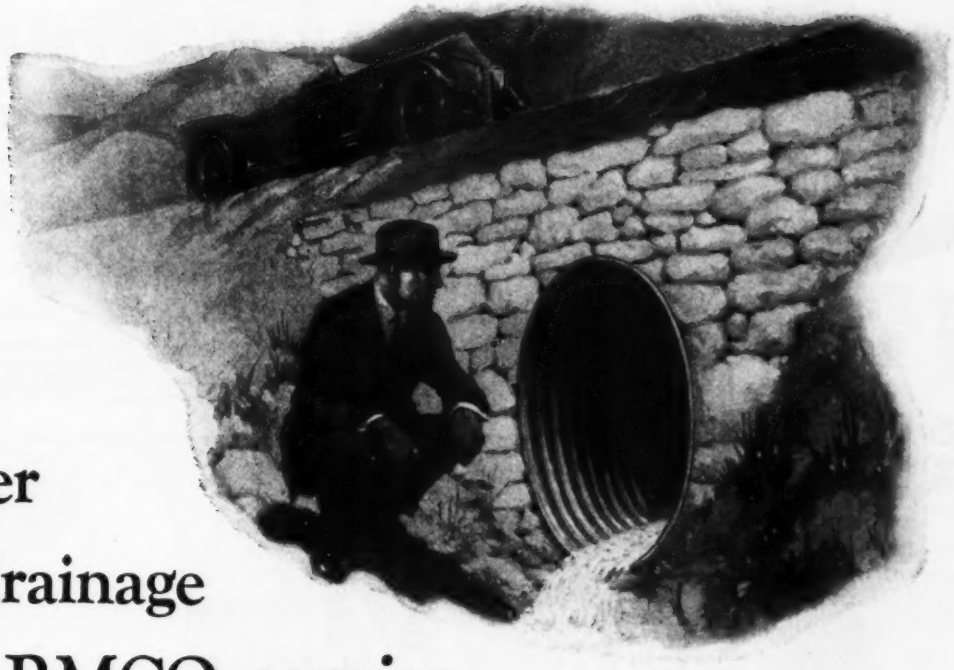
CONCRETE PRODUCTS CORPORATION

Peoples Gas Building, Chicago

Sales Offices: New York, Atlanta, Cincinnati, St. Louis, Los Angeles

Canadian Concrete Products Co., Limited, Transportation Building, Montreal, Que.

Factory-Made REINFORCED CONCRETE PRODUCTS



Build better drainage *with* ARMCO *service*

IN their work of providing better drainage for better roads, engineers have available a vast fund of facts through the Armco organization. These facts have been accumulated through years of intensive study of field conditions throughout the United States and Canada.

Literally thousands of culverts of every type have been examined. These findings have been supplemented by exhaustive laboratory tests to prove both strength and capacity of structures.

The Armco organization has brought this information together because it realizes better drainage requires more than better culverts. Culverts must be of correct size and strength and be properly installed.

This year the Armco Association has recorded for the benefit of the culvert user, a number of distinct developments that prove the practical nature of Armco service.

One development was a recently perfected method of jacking culverts through existing embankments. The roadway is not disturbed, there is no interference to traffic. Cost is reduced by more than half, and time saved.

Again, a better subdrainage has been provided through Armco perforated pipe. Tests prove the removal of surface water with this new pipe is a matter of only seconds. Interruption of drainage service from freezing, swelling soils or loads of traffic has been eliminated. A revolutionary development (it has been called the greatest in culvert history) will be announced shortly.

Armco Service is available to anyone interested in better drainage. A valuable fund of information will be found in Armco bulletins or definite recommendations will be worked out for specific requirements. There is no obligation. Ask for your copy of our bulletin "Building Better Drainage With Armco Service."

ARMCO Ingot Iron

ARMCO CULVERT & FLUME MFRS.' ASSN.
MIDDLETOWN, OHIO

ARMCO CULVERTS

Consistent Performance Because of Consistent Uniformity

Durable All the Way Through—

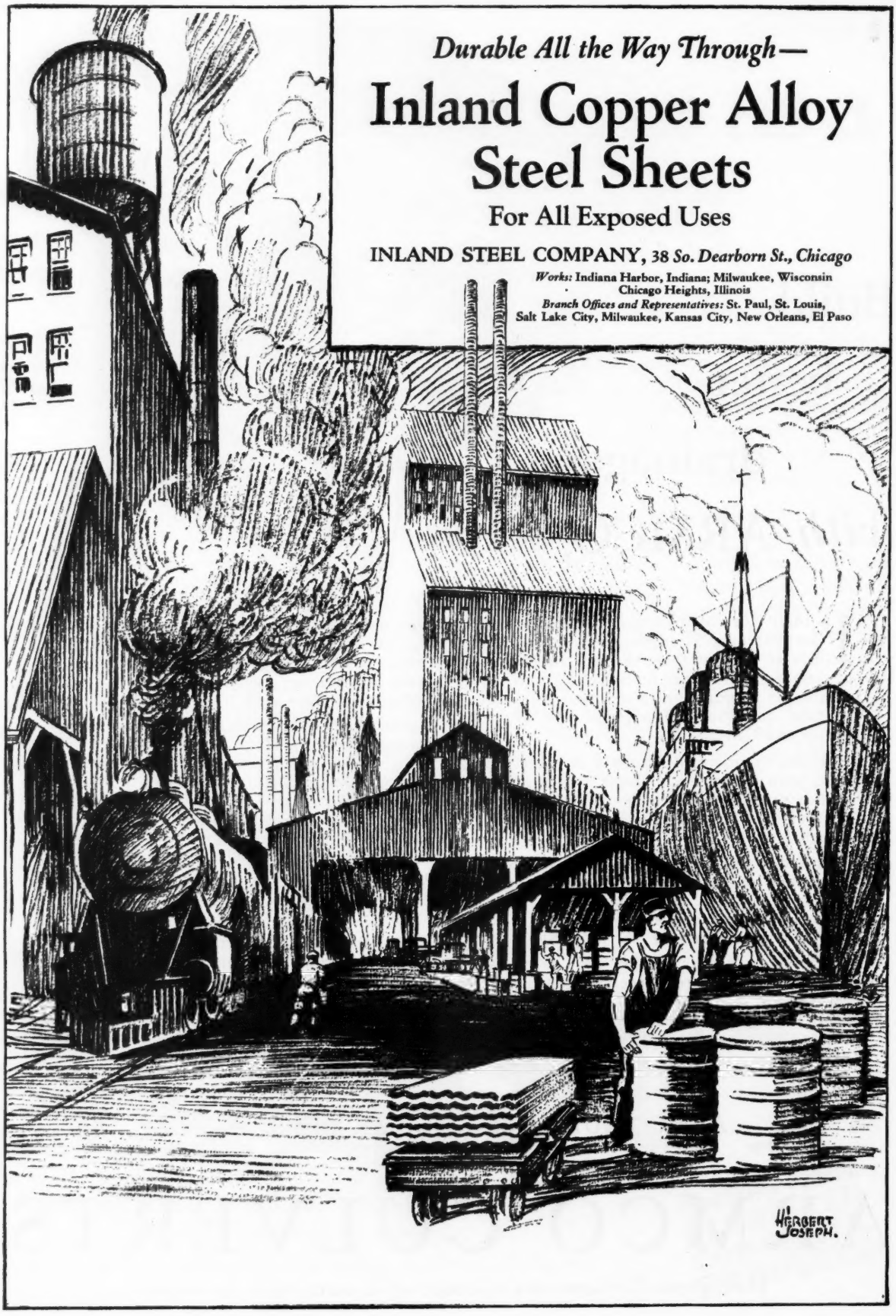
Inland Copper Alloy Steel Sheets

For All Exposed Uses

INLAND STEEL COMPANY, 38 *So. Dearborn St., Chicago*

Works: Indiana Harbor, Indiana; Milwaukee, Wisconsin
Chicago Heights, Illinois

Branch Offices and Representatives: St. Paul, St. Louis, Salt Lake City, Milwaukee, Kansas City, New Orleans, El Paso



A Mouthful at Every Bite

Guarantee
Owen Buckets, properly installed and operated, are guaranteed to do a bigger day's work than any other bucket of the same weight and capacity—
—or—
Write your own guarantee!
OWEN BUCKET CO.

WHEN A bulldog gets a grip, not even boiling water will force him to open his jaws.

When an Owen Bucket strikes the material, the teeth or cutting edges sink far down—and as the closing power is applied, they dig in deeper and deeper. No letting up on that tremendous bite! And the same two factors are responsible in both bulldog and Owen Bucket; concentrated weight and relentless closing power.

A bulldog's weight is where it will do the most good. The same is true of an Owen Bucket. Sixty percent of it is concentrated on the main shaft, to hold the bucket down, resist the upward pull of the closing action, and keep the bucket from "riding" or scraping instead of digging.

Tremendous closing power drives the cutting edges through the material. Like the stubborn bulldog, the Owen Bucket gets A Mouthful At Every Bite.

THE OWEN BUCKET CO.
6019 BREAKWATER AVENUE
CLEVELAND, OHIO

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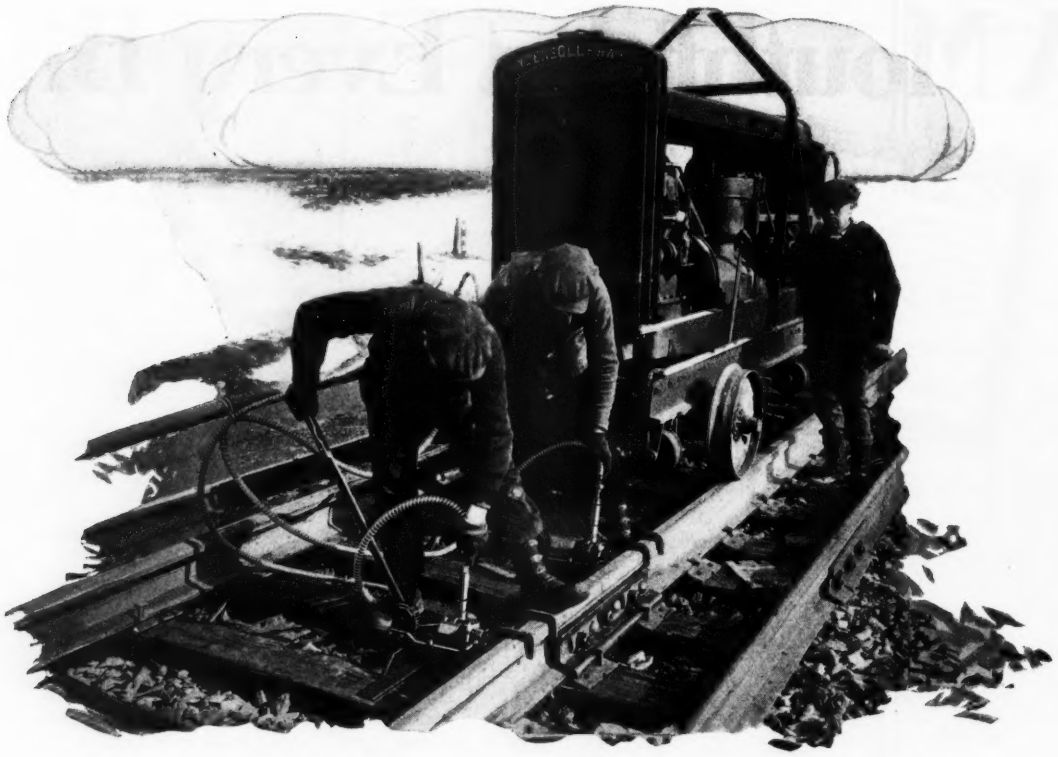
OWEN CLAMSHELL BUCKETS INSURE A BIGGER DAY'S WORK

Owen Buckets



Year-round savings are made with compressed air tie tamper units

Ingersoll-Rand Tie Tamper Air Compressors are such convenient and handy sources of power that they are used to save time and labor on dozens of operations. In addition to operating tie tampers, they supply air power for a wide variety of labor-aiding appliances.

In rail laying operations they are used to operate rail drills, bonding drills, and pneumatic wrenches. On one job a tie tamper compressor and bonding drills averaged 70 holes per hour per drill—the work progressing ten times faster than when hand methods were used.

Ask for complete information on all the labor saving uses of Ingersoll-Rand tie tamper outfits.

INGERSOLL-RAND COMPANY
11 Broadway New York City

Offices in principal cities the world over
For Canada Refer—Canadian Ingersoll-Rand Co., Ltd., 260 St. James Street, Montreal, Quebec

Tie Tamper Air Compressor supplying air for rail bonding drills

231-TT

Ingersoll-Rand

Type of Western Automatic Air Dump Car in cinder service on Boston & Albany Railroad, and in construction and maintenance of way on the Santa Fe.

They Make Life Easier for Railroad Men

The above type of Automatic Air Dump Cars—the Western—is meeting with great favor among railway maintenance engineers.

The Boston & Albany Railroad is using them as the most efficient and economical method for hauling and dumping locomotive cinders utilized for bank widening.

They are equally useful in ditching and construction and we gladly will refer you to railroads where they are in such service.

The Western is an all-service and all-year car. When New England Railroads were digging out from under the snow last winter hundreds of Western Air Dump Cars were used in the hauling.

FACTS THAT MAKE WESTERNS POPULAR

They make life easier for overworked railroad men.
They make maintenance of way work cheaper for the company.
They dump either way by air instantly without preparation.
An apron attachment helps clear the ballast.
They can be righted when desired without shovelling or moving up the train.

We gladly will help you investigate or give you additional information. Write to-day.

Western

That's Why

Western Wheeled Scraper Company

Founded 1877

Builders of Dump Cars and Earth and Stone Handling Equipment

AURORA, ILLINOIS

RACOR

SEVEN WORKS
RAMAPO-AJAX-ELLIOT
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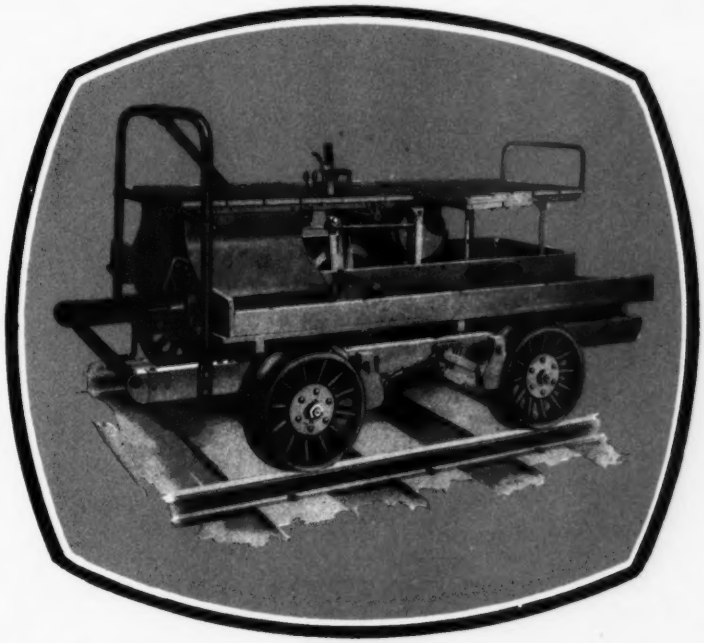


The Sheffield 40-B

Automobile type pressed steel frame.

Air-cooled, two-cylinder, four-cycle engine designed for exceptional torque at low speeds.

Three-point suspension of engine.

Timken roller bearings in engine and axle bearings.

Greatly simplified transmission.

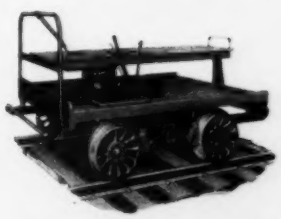
Abreast of the most advanced automotive engineering

In the Sheffield 40-B—the *fine* car of section motor cars—and in the Sheffield 45—the newest Fairbanks-Morse car—the best features of automotive engineering have been incorporated. Sheffield Motor Cars, the pioneers, still definitely lead the field.

The Sheffield 40-B gives you *super* performance. Plenty of power for trailing loads on grades, for pulling against head winds—for the extraordinary as well as the usual demands.

The Sheffield 45, patterned after the "40-B" but less highly powered, gives remarkable economy in all ordinary section and extra gang service. It has the largest deck space ever provided on a section car—22 square feet of unobstructed surface. Ask for special bulletins on these and other F-M Section Motor Cars.

FAIRBANKS, MORSE & CO., *Chicago*



The Sheffield 45

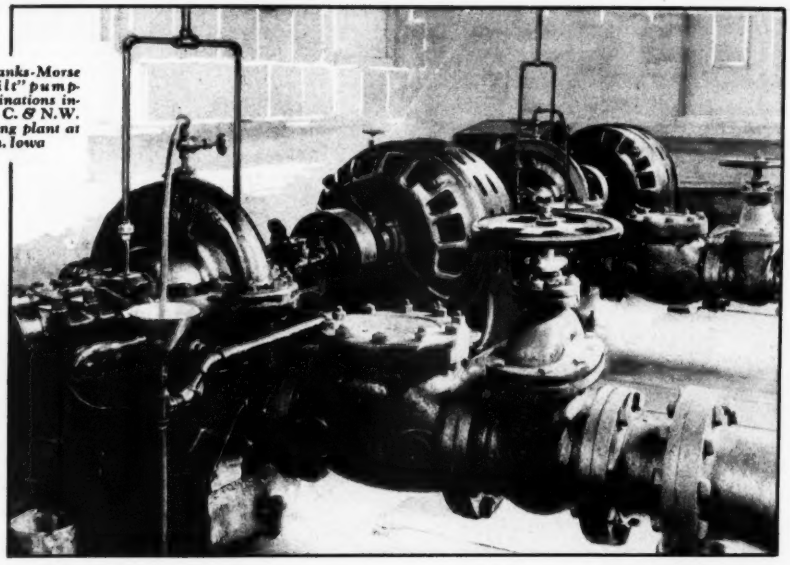
Patented Ricardo cylinder head gives more power.

Three-point suspension of engine.

Crankshaft mounted on Timken bearings; countershaft on SKF self-aligning ball bearings. Auto-type pressed steel frame.

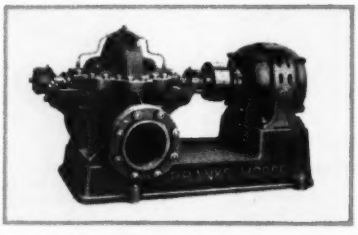
Largest deck space ever provided on section motor car.

FAIRBANKS-MORSE
MOTOR CARS

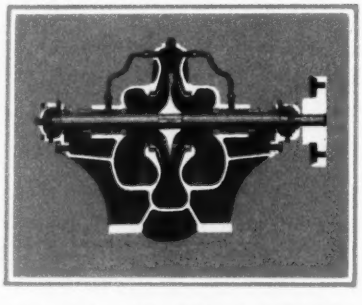


Two Fairbanks-Morse "Unit-Built" pump-motor combinations installed in C. & N.W. R. R. pumping plant at Clinton, Iowa

Taking the uncertainty out of pumping



The Fig. 850 "Unit-Built" F-M pump-motor combination for moderate heads. Both pump and motor bearings are ball bearings. Ball-bearing units are also built for high heads



Sectional view of Fig. 850 pump which is illustrated above. Note streamline water passages and bearings sealed in outboard boxes away from water

When you install a Fairbanks-Morse "Unit-Built" pumping combination you need consider only the head and volume required. The problems of motor selection, choice of drive, etc., are automatically eliminated.

Such an installation forestalls all possibility of error. The motor is built by Fairbanks-Morse—balanced to the pump in F-M laboratories. Fairbanks-Morse is responsible not only for the pump and motor individually, but for the operation of the unit as a whole.

Typical of the comprehensive line of trim, compact F-M pumping units is the motor-pump combination illustrated at the left. Both pump and motor are equipped with ball bearings which assure vibrationless operation and precise clearance between impeller and wearing rings as well as between rotor and stator in the motor. Units of this type are built for a wide range of pressures and volumes covering a large number of pumping plant requirements.

FAIRBANKS, MORSE & CO., *Chicago*

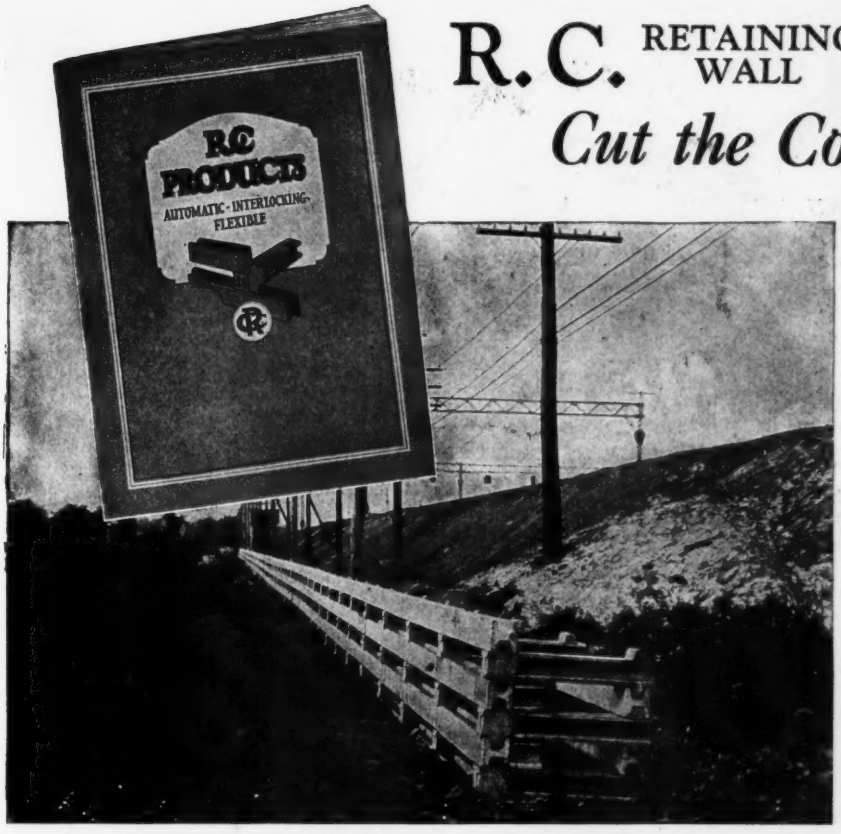
28 branches in principal cities at your service

FAIRBANKS-MORSE

PUMPS · MOTORS · DIESEL ENGINES

AB46-A(PRIA21.10

F M



R. C. RETAINING WALL UNITS

Cut the Cost 50%

—because

1. They automatically interlock and square away. Only two units. No skilled labor required.
2. No galvanized dowels or troublesome fittings. No pillow or filler blocks, thus eliminating mason work of ANY kind.
3. No massive foundations or drainage problem.
4. 100% salvageable—tear down quickly and move to next job.
5. Can be specified as definitely as structural steel—with assured results.

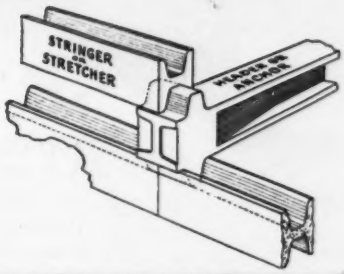
Send for this Free Book

of Retaining Wall Data

IT gives actual comparative costs—showing how R. C. Precast Concrete Units save more than half the cost of retaining walls. It illustrates a wide variety of installations by railroads and other prominent users. It shows retaining wall details and gives standard specifications. Also many other useful items for the engineer and contractor.

Send the coupon for your copy—for immediate use or for your file.

THE R. C. PRODUCTS COMPANY, Inc.
ENGINEERS BUILDING, CLEVELAND, OHIO
New York Chicago Norfolk Indianapolis San Francisco



As Used by the Illinois Central

The photograph above shows an R. C. installation in the Markham Yards of the Illinois Central. This wall was built for 10c per square foot—a saving of about 75% over usual monolithic construction.

The R. C. Products Co., Inc.
Engineers Bldg., Cleveland, Ohio

Send me your free book of Retaining Wall Data ☐
Also complete information on the use of R. C. Units for the following purposes_____

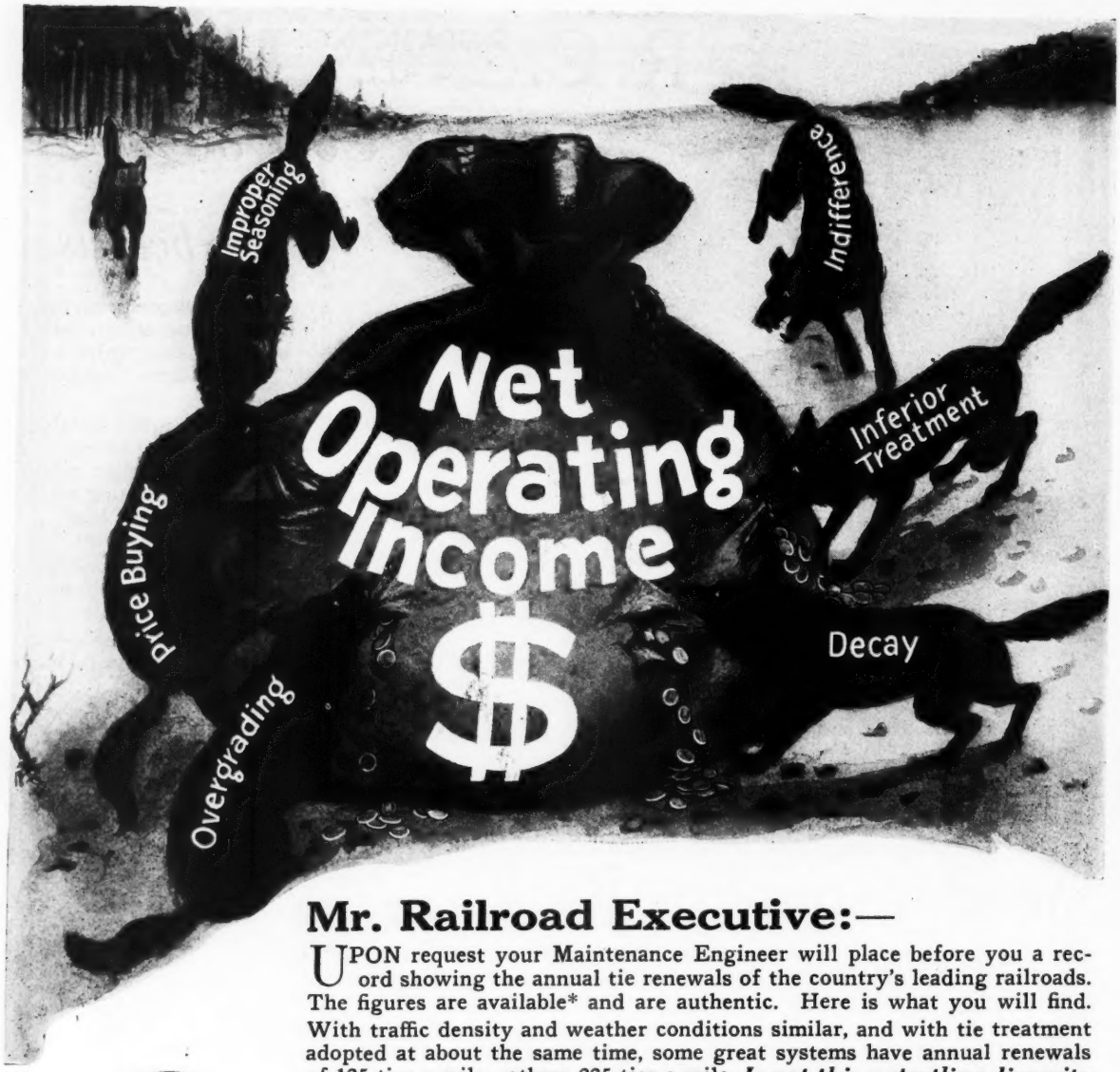
_____

*Company Name*_____

*Individual's Name*_____

*Address*_____

PRECAST AUTOMATIC PRODUCTS INTERLOCKING CRIBBING FLEXIBLE



Mr. Railroad Executive:—

UPON request your Maintenance Engineer will place before you a record showing the annual tie renewals of the country's leading railroads. The figures are available* and are authentic. Here is what you will find. With traffic density and weather conditions similar, and with tie treatment adopted at about the same time, some great systems have annual renewals of 125 ties a mile—others 225 ties a mile. ***Is not this a startling disparity in so great an item of railroad expenditure?***

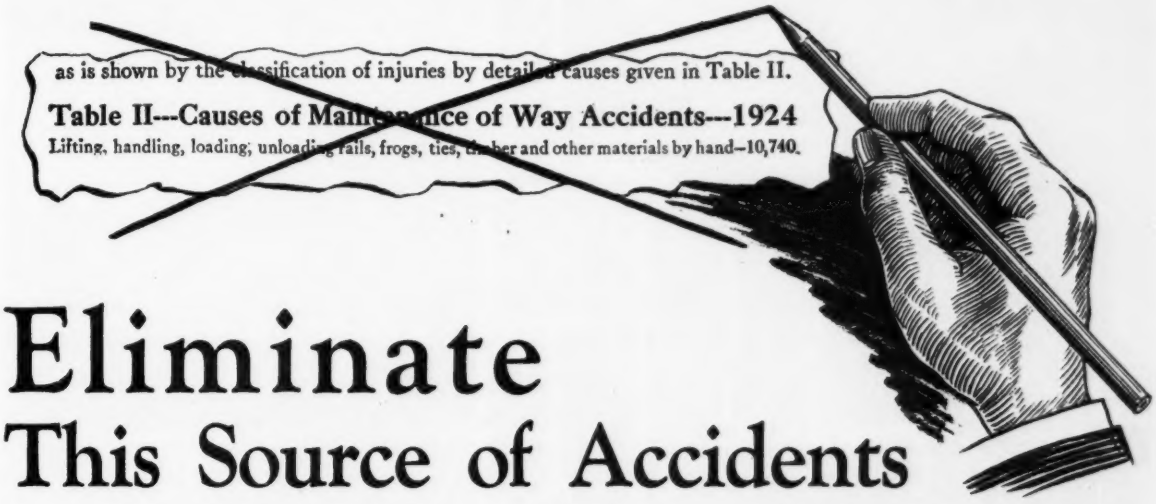
A treated tie in your track is worth at least $2.75. This difference of 100 ties means a difference of $275 a mile. Where does your road stand? Is each mile of it costing $275 more—or less, per year, than the road alongside? Ties of sound wood, strictly A. R. E. A. graded, properly treated with pure preservative, give the low annual renewal figure. ***International*** can ship you such ties immediately and in any quantity.

2IC6
The International Dating Nail

*Report of annual renewals can be obtained on request from:
American Railway Engineering Association, 431 South Dearborn Street, Chicago, Ill.*

International Creosoting & Construction Co.
General Office—Galveston, Texas

International
STANDARD SPECIFICATION TIES


as is shown by the classification of injuries by detailed causes given in Table II.
Table II---Causes of Maintenance of Way Accidents---1924
Lifting, handling, loading, unloading rails, frogs, ties, timber and other materials by hand--10,740.

Eliminate This Source of Accidents

More than 10,000 accidents in a single year caused by the handling of rail and other heavy materials by hand—that is startling evidence of the need for the Parsons Rail Crane. Many transcontinental roads have already taken steps to stop these accidents by using the Parsons Rail Crane for the handling of rails, ties, bridge timbers, and other heavy materials.

PARSONS RAIL CRANE

Does the work safely—and at lower cost.

THE Parsons Rail Crane protects men from the danger of strains, wrenches, sprains, or ruptures caused by lifting rails or other heavy materials. And in addition to increased safety, the Rail Crane brings tremendous reductions in the cost of the work.

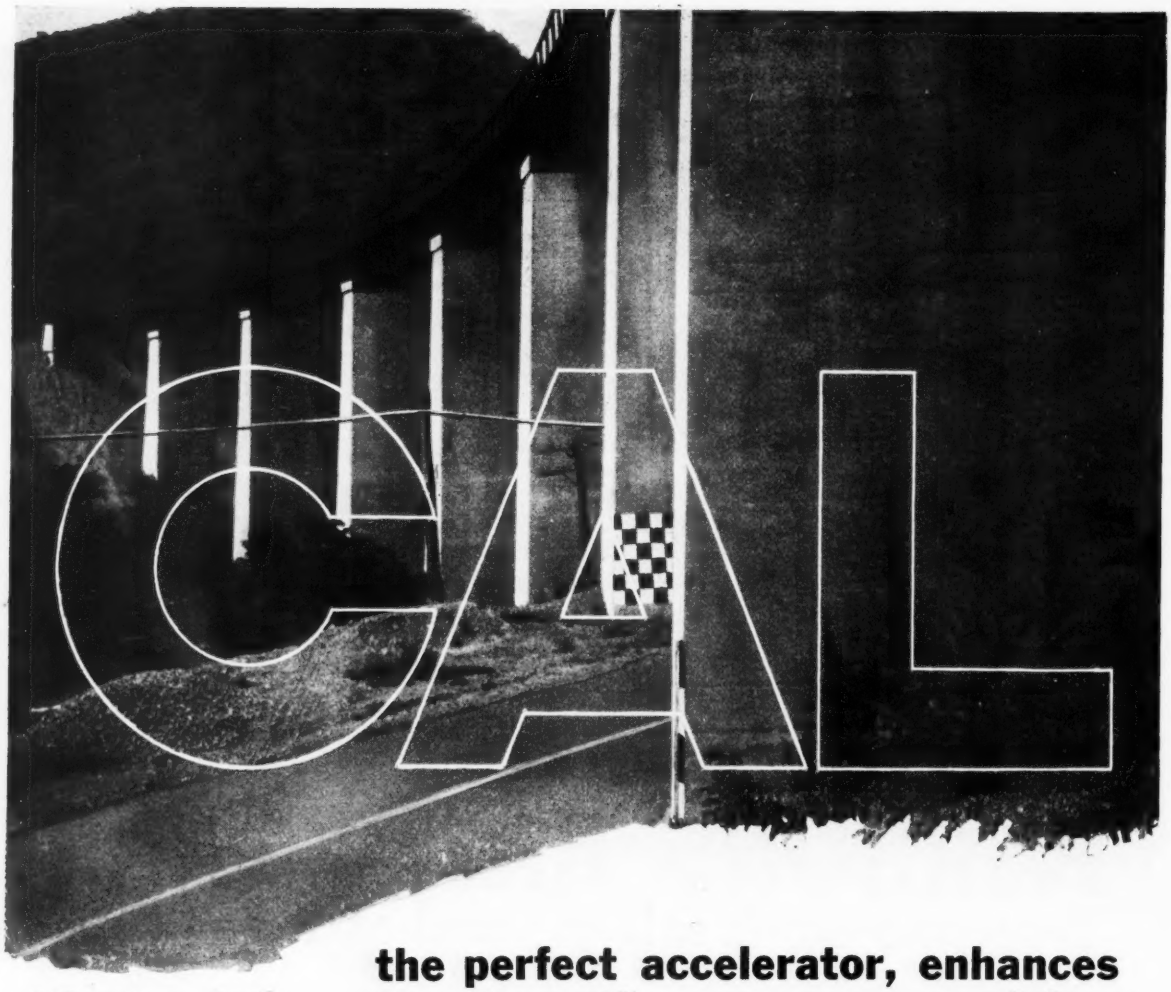
Investigate the Rail Crane thoroughly. Ask us for names of officials who are already using it. Interesting booklet, "The Modern Way to Handle Rail," sent free to railroad men. Write for your copy today. Use coupon below.

THE PARSONS COMPANY
Newton, Iowa

The Parsons Company
Newton, Iowa
Please send me my copy of "The Modern Way to Handle Rail."

Name..... *Railroad*.....

Address.....



CAL fattens, hardens, densifies, waterproofs, and frostproofs all Portland cement. There is only one Cal on the market, Oxychloride of Calcium which cannot be obtained in any other form. As easy to use as Portland cement.

For QUICK HARDENING CONCRETE
For WATERPROOFING FROSTPROOFING AND FATTENING CONCRETE MORTAR and STUCCO
USE CAL
Ready for Work
WITH YOUR FAVORITE BRAND OF PORTLAND CEMENT

the perfect accelerator, enhances the strength, permanence and durability of all concrete construction

WHATEVER your concrete construction requirements or demands of service—whether the job requires one bag of Portland Cement or carloads, Cal, the perfect accelerator, will insure greater strength, permanence and durability. In every class of concrete work over a period of years, Cal has consistently proven its ability to make the best concrete job better.

Men appreciate the convenience of Cal—a dry white ready prepared powder added to Portland Cement at the mixer. It is a safeguard against the mistakes of omission or overtreating.

Through its chemical action and the fact that much drier mix can be used a "quick strength" concrete is obtained. Where forms are used only 50% of the required number are usually necessary with Cal—a tremendous saving on hundreds of jobs, both in material and labor costs.

NORTH AMERICAN CEMENT CORPORATION

Successor to Security Cement and Lime Company

HAGERSTOWN, MD.

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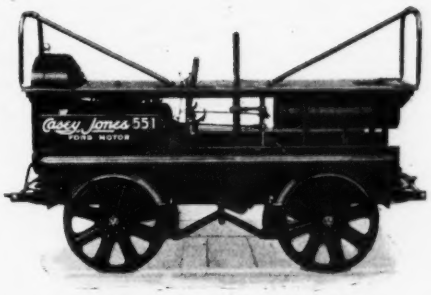
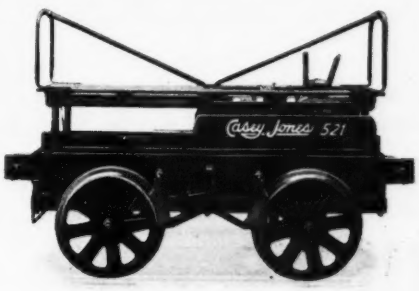
THREE DISTINCT PURPOSES SHOULD REQUIRE THREE DISTINCT TYPES OF RAILWAY MOTOR CARS

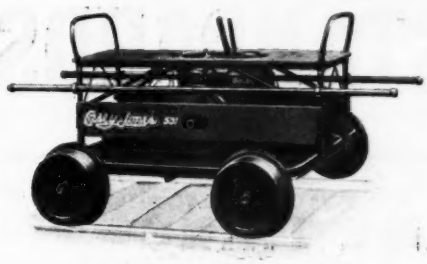
Casey Jones HAS A CORRECT TYPE FOR EVERY SERVICE



HEAVY DUTY SERVICE



STANDARD SECTION



LIGHT INSPECTION

The powerful locomotive used for heavy freight service differs greatly from the passenger train locomotive and the switch engine in the yards. Each serves its purpose efficiently and economically.

Exactly so with the railway motor car. Casey Jones builds a special type of car for each purpose fully capable for the work intended, doing each job better and at lower cost.

CASEY JONES 551 HEAVY DUTY MOTOR CAR equipped with standard Ford Motor is the most powerful and efficient car for extra gangs, bridge crews, hump service, operating discing machines and mowers and all heavy duty service.

CASEY JONES 521 STANDARD SECTION MOTOR CAR equipped with 6 H.P. water cooled engine and dependable belt drive is the most efficient and practical for the section gang.

CASEY JONES 531 SAFETY FIRST INSPECTION CAR is a light and powerful car of simple and efficient design for one to four men.

CASEY JONES MOTOR CARS ARE CLASSIFIED FOR SERVICE IN THREE CLASSES AS RECOMMENDED BY THE MOTOR CAR DIVISION OF THE A. R. E. A.

THE RIGHT CAR FOR EVERY CLASS OF SERVICE			
Class A	For Heavy Duty	Casey Jones 551	4 to 150 Men—Trailers
Class B	For Standard Section	Casey Jones 521	2 to 30 Men—Trailers
Class C	For Light Inspection	Casey Jones 531	1 to 4 Men

NORTHWESTERN MOTOR CO.

FACTORY AND GENERAL OFFICES
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Railway Exchange
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BANK & GOODELL
606 Merchants Bank Bldg.
SAN FRANCISCO
W. H. WORDEN CO.
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PORTLAND
WESTERN RAILWAY SUPPLY CO.
10th & Johnson Sts.
FOREIGN
KOPPEL INDUST. CAR & EQUIP. CO.
Koppel, Pa., Exclusive Export Agents

LEST WE FORGET

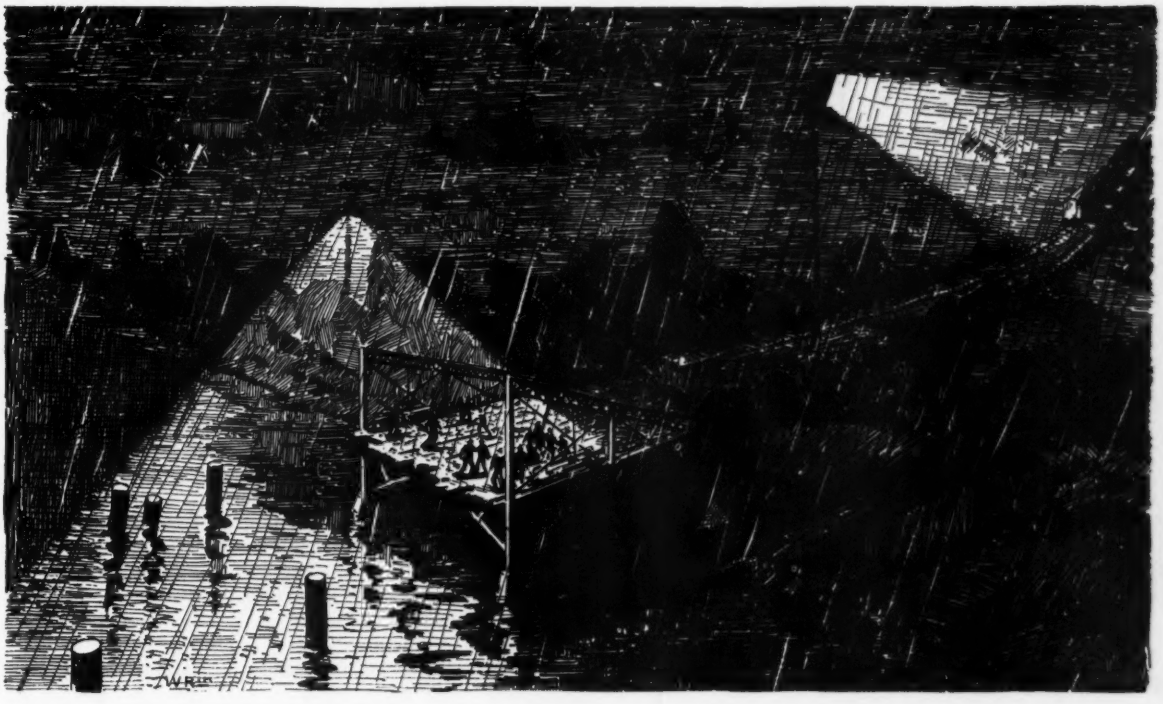
WHAT'S ONE MAN'S FOOD IS ANOTHER MAN'S POISON

OUR PRODUCTS ARE RAILROAD STANDARDS

NOT WITH THE SAME THING FOR EVERYBODY BUT WITH SOMETHING WORTH WHILE FOR ANYBODY

The Rail Joint Company

165 Broadway New York City



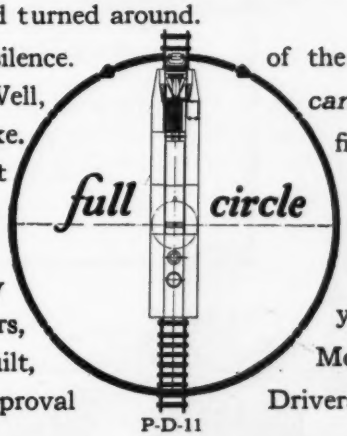
"Boys, the driver's comin' wrong end first!"

THAT was the last straw. The spirit seemed to ooze from the small group of weary men who stood watching the pile-driver coming thru the falling darkness.

After laboring night and day in a stubborn drizzle . . cleaning up twisted wreckage left by the swollen, lashing river that had crushed the bridge like so much straw . . . driving themselves to the exhaustion point to make good their promise: *"The trains go thru tomorrow morning,"* . . . and after seeing victory in sight—it was a heart-breaker to see that pile-driver coming wrong-end first. It meant a five-hour delay while the driver back-tracked and turned around.

After the cry, there was a long silence. Then the engineer spoke. "Well, boys, we're licked, and no mistake. Might as well turn in and report after breakfast. I'll 'phone that the trains can't come thru."

This incident illustrates why McMyler - Interstate Pile Drivers, the only full-circle drivers built, meet with the enthusiastic approval of the mechanical departments. They *cannot* arrive on the job wrong end first, because a circle *has no ends*



P-D-11

If there is any doubt as to the value of this feature, ask the men who have to use the drivers. Do you wish complete information on McMyler-Interstate full-circle Pile Drivers?

McMyler-Interstate

CLEVELAND, OHIO

MAKERS OF POWDERS SINCE 1802

Farming used to be an extremely primitive occupation, before the invention of mechanical farm labor.

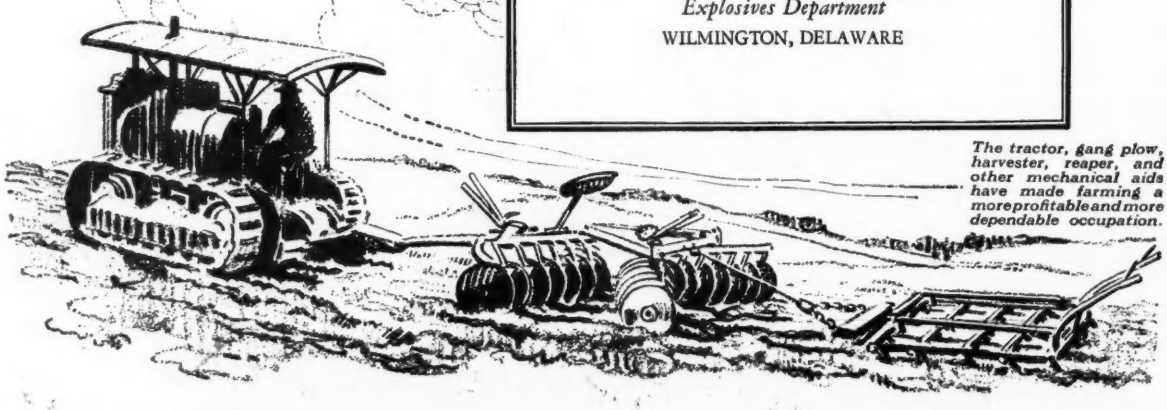
Facilities

that assure satisfaction

MERELY assembling materials and putting the machinery to work for manufacturing explosives is comparatively easy. However, to produce, out of hand, those intangible and wholly indispensable facilities representing the constant efforts of many years, is a most difficult accomplishment.

The experiences acquired in a century and a quarter of explosives manufacturing and the observations of explosives experts have provided the du Pont Company with adequate facilities to cope with the present demands for explosives. With its plants strategically located and sufficient production assured, du Pont explosives can be specified with entire confidence as to prompt deliveries and satisfactory performances.

E. I. DU PONT DE NEMOURS & CO., Inc.
Explosives Department
WILMINGTON, DELAWARE

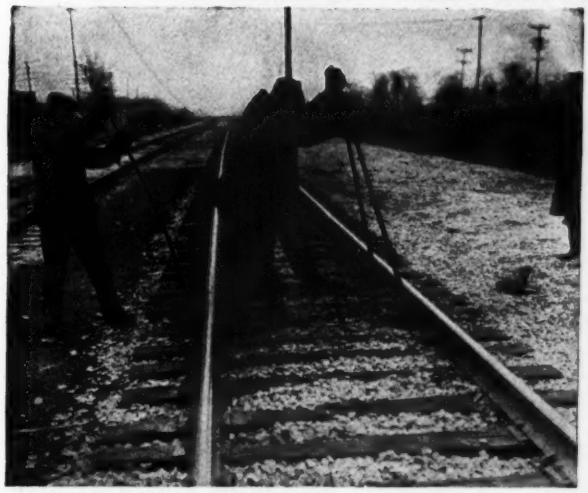


The tractor, gang plow, harvester, reaper, and other mechanical aids have made farming a more profitable and more dependable occupation.

125 YEARS OF LEADERSHIP IN THE SERVICE OF INDUSTRY

SAVE 60% OF YOUR LABOR AND TOOL COST

NOW IN USE ON OVER 100 RAILROADS

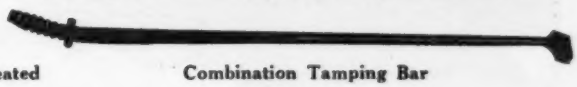


Showing Bar Set in Bottom Notch for First Throw

Showing Bars Set in Upper Notch for Second Throw

Combination Lining Bar

Heat Treated



Combination Tamping Bar

REASONS WHY YOU SHOULD USE HACKMANN COMBINATION TRACK LINERS

They will line track, frogs, switches, raise low joints and space ties.

Can be operated against the end of switch ties when lining turnouts and puzzle switches.

You can make at least two pulls without resetting the base.

Three to five men can now do the work formerly done by seven to nine men and seven men can do the work of fifteen to twenty men.

They will pay for themselves in a very short time in the saving of labor and tools.

Recent tests have shown that it is not necessary to resurface track when laying new rail on old ties. It has been found that the road bed is in better shape and more solid when not disturbed and in many cases will save this cost of resurfacing for some time to come.

Hackmann Combination Track Liner
Weight 20 lbs.

The lining and tamping bars are heat treated and the base is made of steel. Base weighs only 20 lbs.

Our track liners are made of only two parts. Nothing to get out of order; very little digging necessary to set liners.

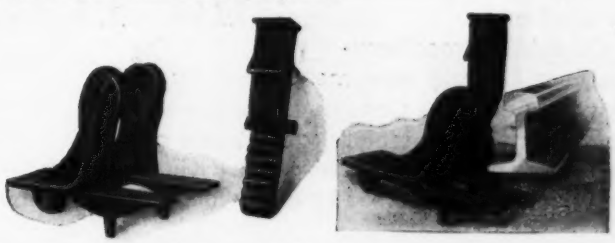
The use of these tools eliminate the constant use of other tools in connection with its performance.

Track lined with our liners remain in place longer than when lined with ordinary lining bars, as you do not disturb the roadbed.

More satisfactory results can be obtained with the Hackmann Track Liner than any other liner on the market.

WE ARE STUDYING YOUR PROBLEMS AND WILL GLADLY DEMONSTRATE OUR METHOD OF LINING TRACK ON REQUEST

Hackmann Idol Track Liner



Hackmann Duplex Track Liner

FOR USE WITH ANY ORDINARY LINING BAR

THE HACKMANN RAILWAY SUPPLY CO.

RAILWAY LABOR SAVING DEVICES—723 So. Wells St., CHICAGO, ILL.

FREDERICK HACKMANN,
President and Mechanical Engineer

J. J. FRANZEN,
Secretary and Treasurer

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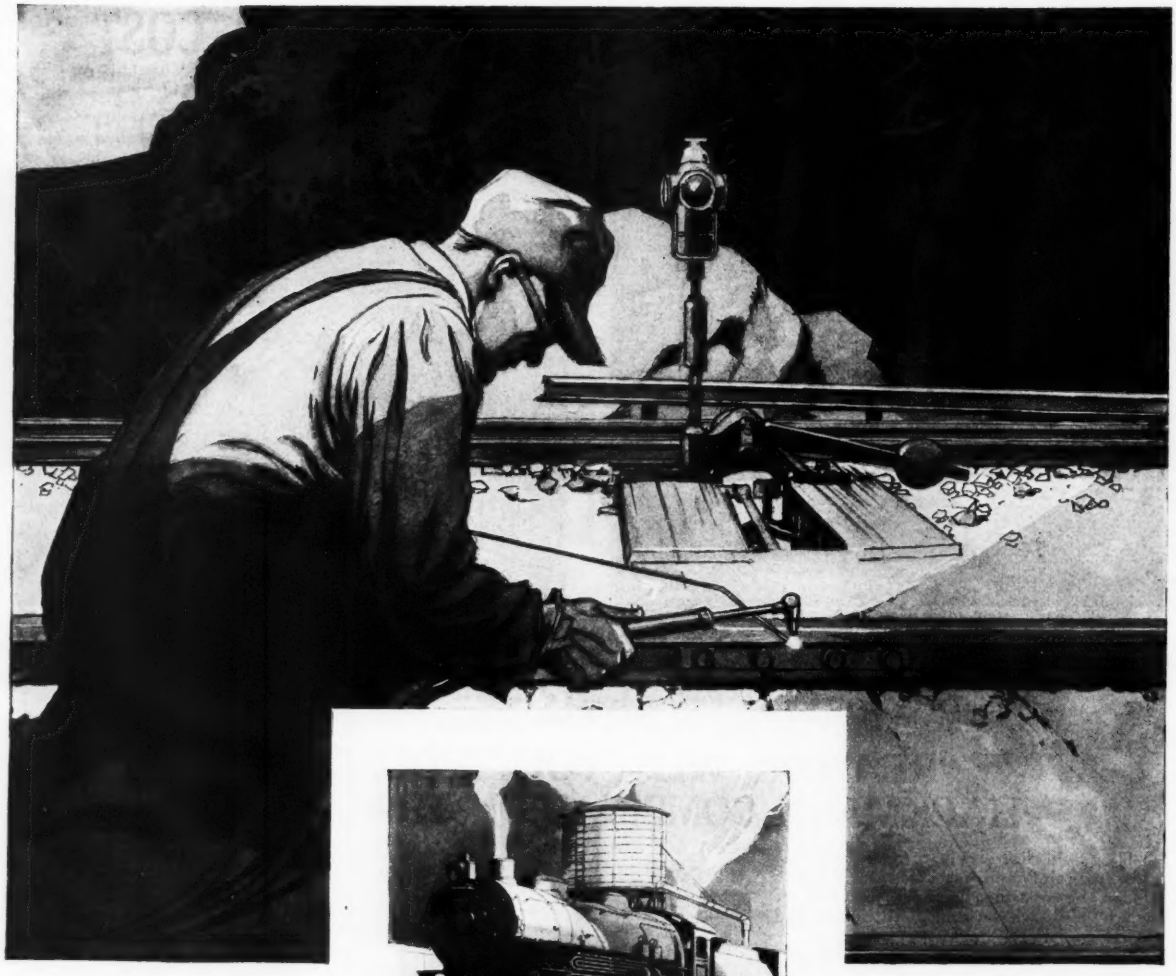
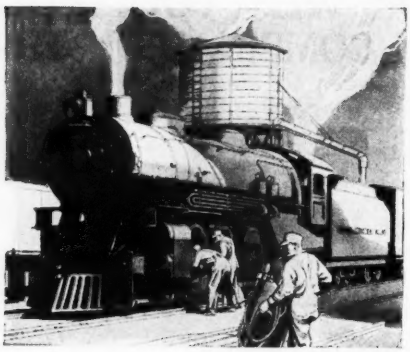




SERVICE and TOOLS

IN THE oxy-acetylene process, as in all industry, the operator needs first-class tools that are rugged, simple and convenient. Good welding and efficient cutting are tremendously promoted by good tools.

Oxweld Railroad Service uses Oxweld equipment made by the Oxweld Acetylene Company. For fourteen years Oxweld blowpipes, generators and regulators have been the recognized leaders and have been endorsed by every industry.

Each railroad served by Oxweld Railroad Service presents special conditions and individual problems. This requires a competent and expert staff which numbers more than 200 men and which during its fourteen years of life has adapted the oxy-acetylene technique to a wide range of railroad work.

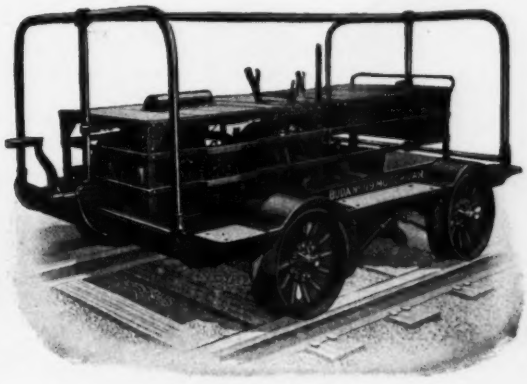
The job has been considerably simplified by equipment that is reliable, rugged and convenient.

THE OXWELD RAILROAD SERVICE COMPANY

New York City: Carbide and Carbon Building *Chicago:* Railway Exchange

Oxweld Railroad Service

Buda Rolled Steel Wheel



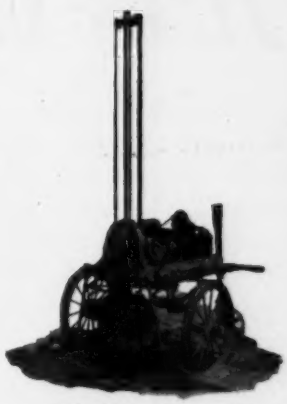
Buda No. 119 Motor Car

Buda All Steel Bumping Post

Buda-Clark Track Lines

Buda 50-Ton Ball Bearing Journal Jack

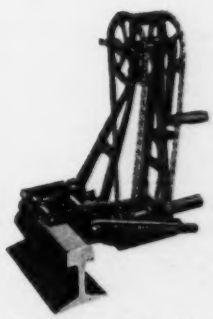
Illustrations of a few of Buda Products that have made a reputation so celebrated that the word BUDA always carries the memory of "Quality and Service."



Buda-Hubron Earth Drill

Buda Paulus Hyduty Track Drill

Buda Crossing Gates



Buda-Wilson Drill with Liberty Clamp

Write for descriptive catalogues

THE BUDA COMPANY

HARVEY (Chicago Suburb) ILLINOIS

Railway Exchange CHICAGO	30 Church Street NEW YORK	Railway Exchange ST. LOUIS	405 W. Forsyth St. JACKSONVILLE	664 Mission St. SAN FRANCISCO	75 Evershot Road LONDON, N. 4

3 Reasons why

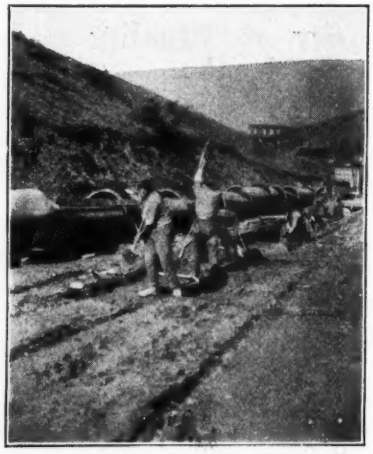
It is the Standard

AFTER each challenge, each attempt to substitute cheaper materials for mains, the dominant position of Cast Iron Pipe has been untouched. The test of time under ground has shown that no pipe line material, that is commercially practical, lasts like Cast Iron Pipe.

Today, Cast Iron Pipe is still supreme in the fields in which its use is the oldest.

Water mains today are made of Cast Iron Pipe because:

1. It is permanent . . . It does resist corrosion.



2. Joints are easily made in the field and are tight.

3. It has high salvage value and can be used any number of times.

These reasons hold for pipe that is new today or pipe that has been in use for half a century. They become of manifold importance when the pipe goes under pavement.

No case has ever come to light where Cast Iron Pipe wore out under average service conditions.

This Bureau will gladly consider any questions on the use of Cast Iron Pipe.

Address: RESEARCH ENGINEER

THE CAST IRON PIPE PUBLICITY BUREAU, PEOPLES GAS BUILDING, CHICAGO

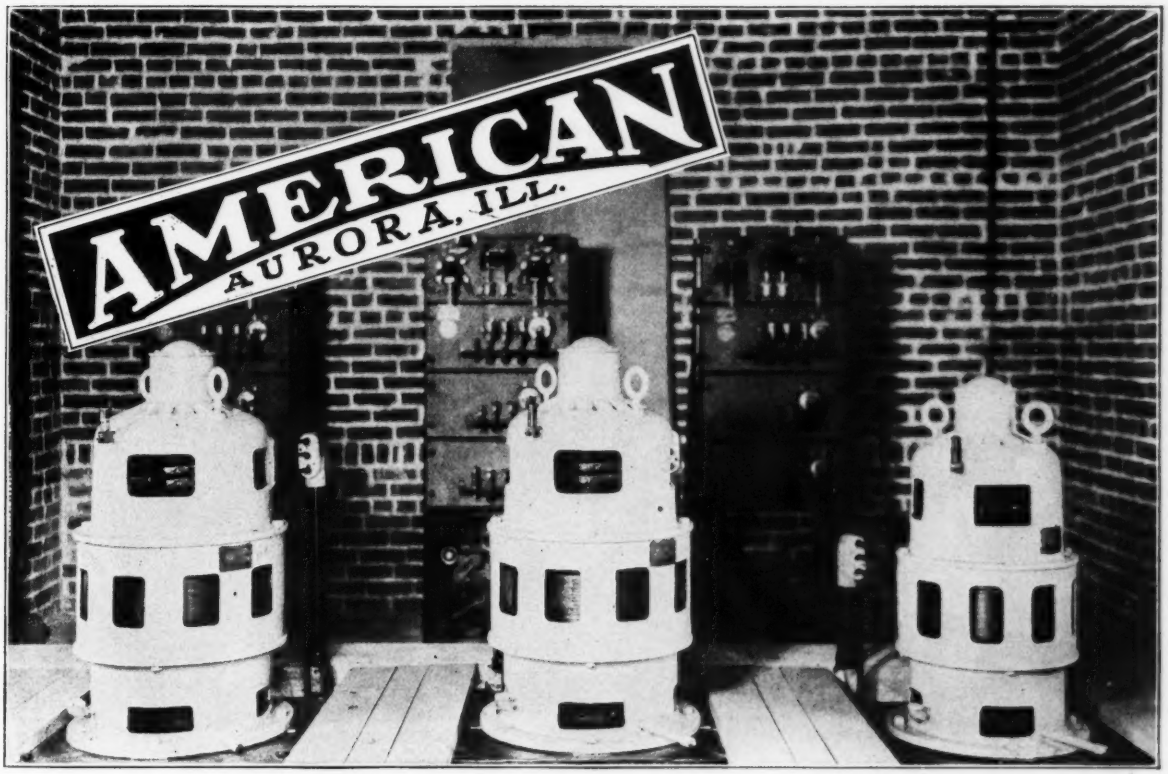
CAST IRON PIPE

Our new booklet, "Planning a Waterworks System," which covers the problem of water for the small town, will be sent on request

THE BELL & SPIGOT JOINT

THE ACCEPTED STANDARD FOR UNDERGROUND CONSTRUCTION

Send for booklet, "Cast Iron Pipe for Industrial Service," showing interesting installations to meet special problems



"American" Sewage Pumps for the City of Winona

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Milwaukee, Wis. . . . . Wisconsin National Bank Bldg.
New York, N. Y. . . . 165 Broadway
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Jacksonville, Fla.
New Orleans, La.
Roswell, N. Mex.
Denver, Colo.
Salt Lake City, Utah
Phoenix, Ariz.
Los Angeles, Calif.
Charlotte, N. C.
Calgary, Alta., Can.

PICTURED are three "American" No. 6 special QMD centrifugal pumps which have been installed in the City of Winona, Minnesota, in the Fifth Sewer District. These pumps have a capacity of 750 G. P. M. at a head of 37 feet, and are driven by 1150 R.P.M. direct connected to 15 H.P. motors.

This entire installation is automatically controlled and six other pumps of the same general nature were previously installed. As a part of this installation the City of Winona has installed a 50 K. W. General Electric Sterling gasoline engine generator unit for auxiliary power for driving the pumps.

"American" centrifugal pumps have been especially designed for sewage service and are the development of over half a century of experience in the design of pumps for municipal water supply and sewage disposal.

Particulars on this installation and many others of a same character may be obtained from "American" engineers.

THE AMERICAN WELL WORKS

General Offices AURORA, ILLINOIS *and Factory*

ONE PRINCIPLE FOR TWENTY YEARS

30 cu. yd. Extension Side Dump Cars in General Construction Work on the Atchison, Topeka & Santa Fe Ry.

AN ALL SEASON—ALL SERVICE CAR

CLARK EXTENSION SIDE DUMP CARS are profitable investments. They assure efficient and economical performance over a wide range of railroad service and can be used throughout the entire year.

In ditcher service, bank widening, rip-rapping, bridge filling, cinder service and general construction work, the "Balanced Principle" assures low cost operation, low cost transportation, rapid dumping, freedom from delays to traffic, more loads per day and less labor to pay.

To serve best and save most, air dump cars should operate on the "Balanced Principle." Extension Side Dump Cars are adaptable to and efficient in all classes of railway service.

CLARK CAR COMPANY
BALANCED DOOR DUMP CARS
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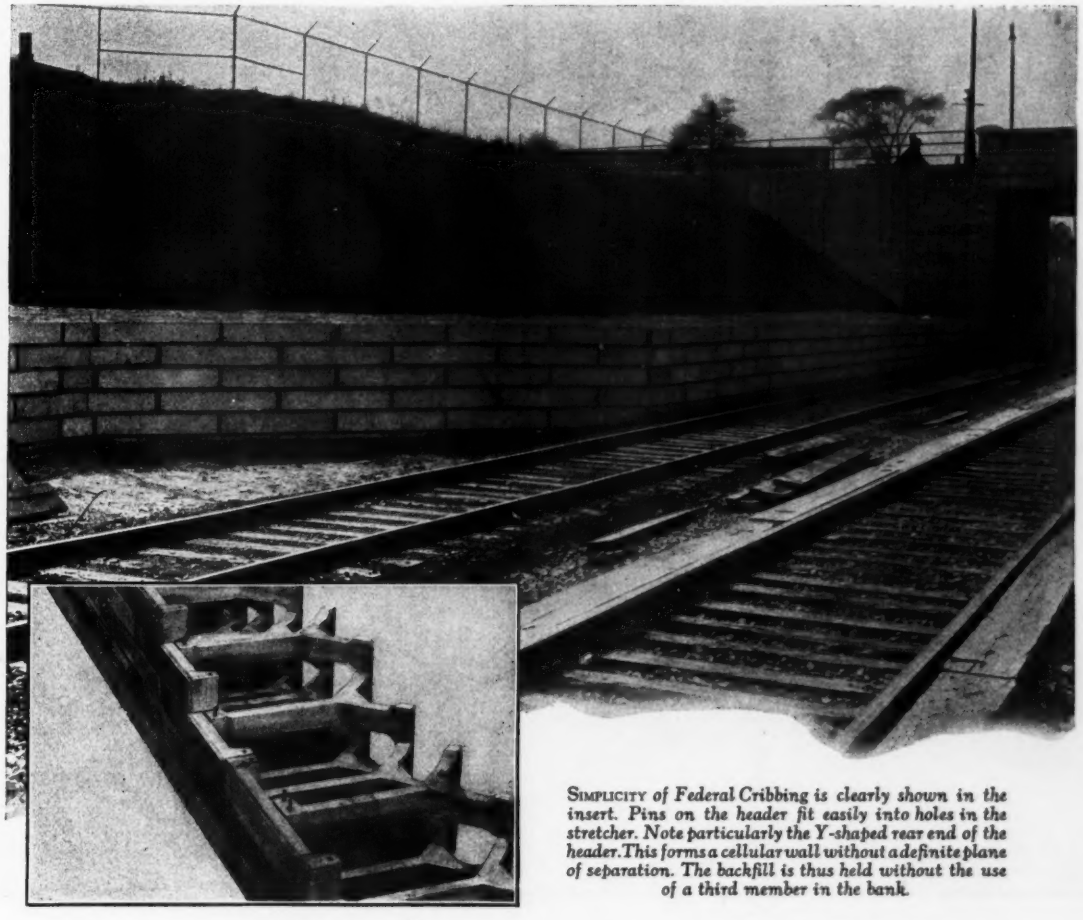

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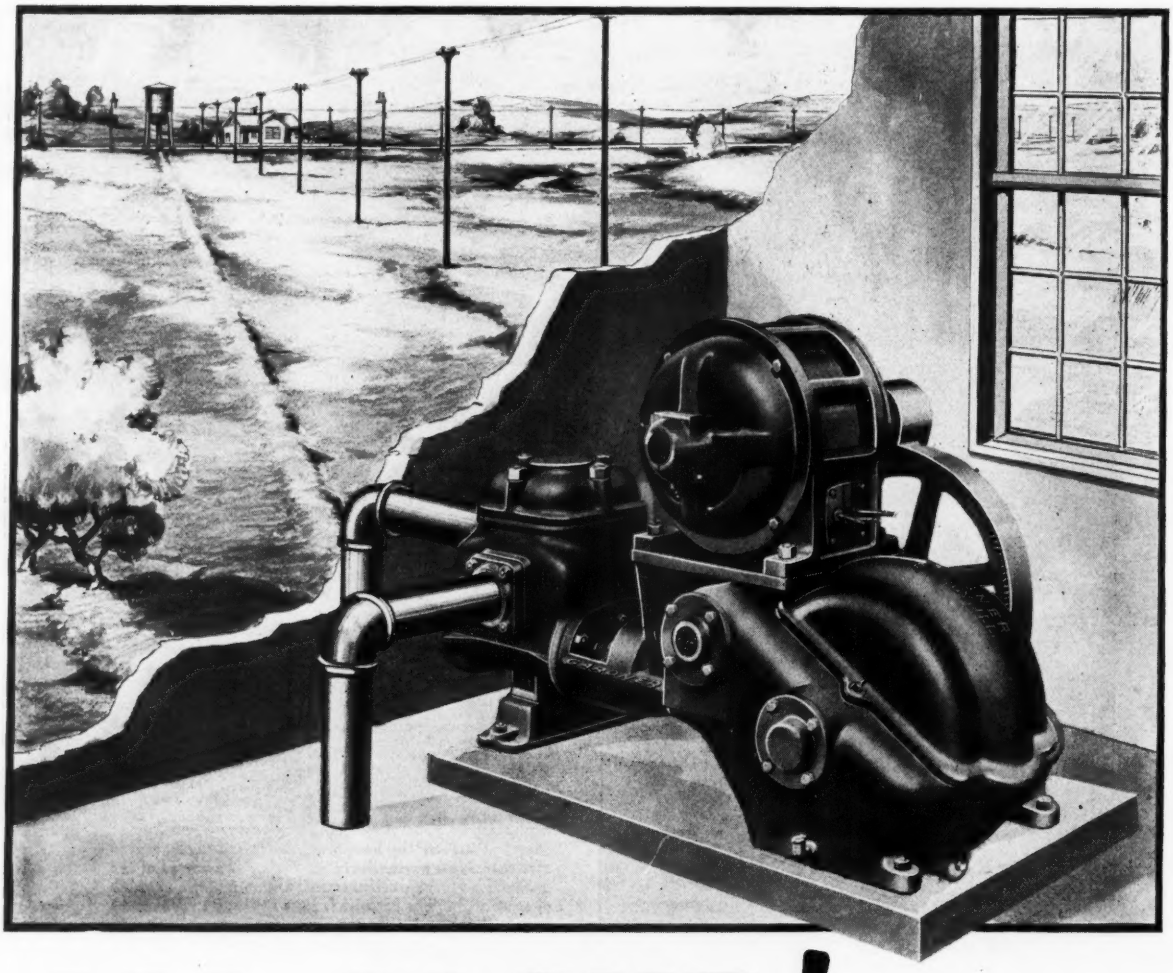

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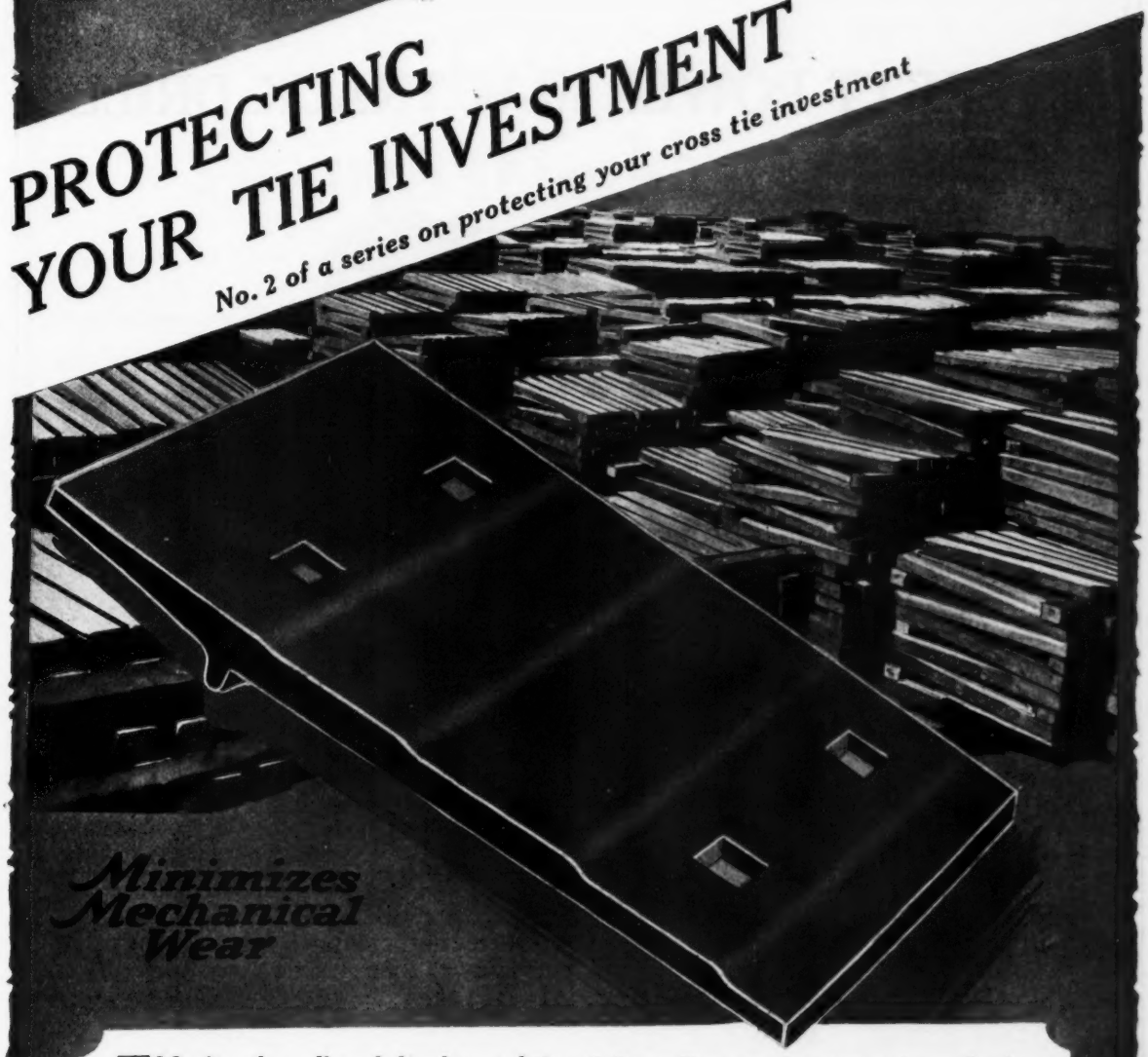
No. 2 of a series on protecting your cross tie investment



TOO often the well graded and treated tie good for 20 years is rendered worthless in from 5 to 10 years through mechanical wear. The wood fibers are broken down by the cutting ribs of ordinary tie plates allowing moisture to penetrate below the safety line of treatment—this is quickly followed by premature decay. Here all of the extra dollars invested for better ties and their treatment to prolong service life has become a total loss.

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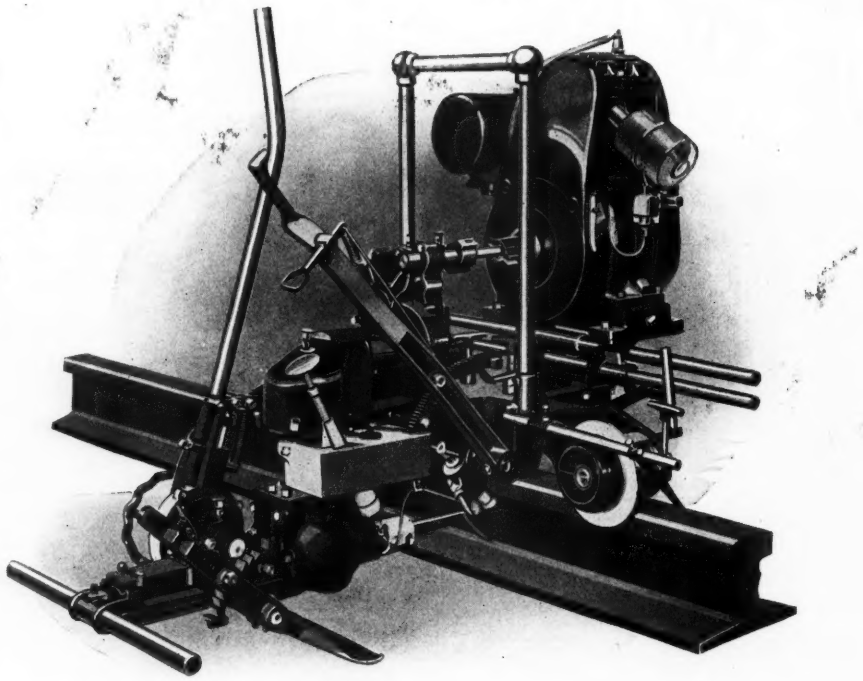

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Railway
Engineering and Maintenance

Volume 22 November, 1926 Number 11

THE SIDE-LOAD CAR IS NOT OBSOLETE

IN SPITE of the widespread impression that has prevailed in many quarters in recent years that the light side-load inspection car is obsolete, the active defense of it by several members of the Bridge and Building Association at the Richmond convention last month showed that it is still entitled to consideration. It is the pioneer in light inspection cars and until a few years ago was used almost unisally. Owing to the ease with which it can be derailed, however, it was the cause of numerous accidents, not a few of which were serious, and as a result the side-load car came to be looked on with disfavor. This led to the introduction of a newer design, wherein the load is distributed uniformly on all four wheels. For this reason, it is less easily derailed. Furthermore, because of the fact that it is, of necessity, a heavier car it is contended that it is somewhat more difficult to remove quickly although this disadvantage has been reduced considerably in recent designs by extension handles and similar expedients. Although the users of side-load cars are far in the minority, the fact that these cars still have advocates who prefer them to center-load cars indicates that it is entirely possible to so maintain the cars that they can be operated with relatively the same freedom from accidents as other cars. It is this possibility that gives courage to the users of side-load motor cars.

A VALUABLE SERVICE

THE United States Department of Commerce is rendering a valuable service to the railways by undertaking the compilation of statistics showing the number of ties purchased each year. Prior to the undertaking of this work the number of cross ties used by the roads has been a matter of conjecture and estimate. The best figures available heretofore have been those compiled by the Department of Agriculture in co-operation with the American Wood Preservers' Association, but, as will be noted on page 451, they are confined to ties treated with preservatives, to the exclusion of those that are put in the track untreated.

The statistics compiled for 1925, which appeared in the October issue, are an improvement over those compiled previously in that the ties are separated between the classes recognized in the A. R. E. A. specifications, thereby showing the number of treated and untreated ties bought of the various timbers. Data of this kind are becoming increasingly valuable from year to year, as the cost of ties is rising and it is becoming necessary to resort to woods previously considered largely or entirely unfit for ties. It is to be regretted, however, that the Department of Commerce has not yet seen fit to separate bridge and switch ties from track ties for their inclusion introduces a factor of uncertainty into the statistics. These figures would be still more valuable if the ties were segregated between track, bridge and switch ties.

A CHALLENGE

THE SAFETY Section of the American Railway Association has set for itself the goal of a 35 per cent reduction in the number of accidents to railway employees by 1930. This objective, when achieved, will constitute one of the most constructive steps ever taken by the railways, for it will mean the conservation of the lives of more than 400 persons annually and the avoidance of injury to many thousands more. As pointed out by T. H. Carrow, chairman of the Safety Section of the American Railway Association, before the recent conventions of the Roadmasters' and the Bridge and Building associations, more than 31 per cent of the accidental deaths of all railway employees occurred among the less than 25 per cent in the maintenance of way department. In other words, the hazard in this branch of the service is greater than on the railways as a whole.

That this is in large measure an unnecessary condition can be demonstrated by a comparison of the accidents on different roads, whereby it can be shown that some roads are practically free of what are classified as unavoidable accidents on others, while the number of accidents from all causes varies widely between roads, even when operating under similar conditions. Thus the accident statistics show that on the railways as a whole bridge and building work is particularly hazardous among maintenance of way activities, although the Duluth, Missabe & Northern has consistently operated for as long as a year at a time without a single reportable accident to any bridge and building man.

The remedy lies in the intensity of the desire to eliminate accidents. Most casualties are avoidable—in other words they are unnecessary. They are the result of haste, carelessness or faulty methods or materials. The initiative for their control rests with supervisory officers. They must inaugurate and enforce precautionary measures. Above all, they must be constantly on the alert to teach safe methods to those with whom they come in contact.

There is no phase of railway activity in which the attitude of the supervisory officer is reflected more directly than here. No safety department, regardless of how officient it may be, can curb accidents. The responsibility rests with the officers in direct charge of operations in the various departments. Without the help of supervisory officers of all ranks in the

maintenance of way department, the goal set by the Safety Section will not be achieved, at least insofar as it relates to this department. On the other hand, with the full support of every one, it is possible to achieve this goal by 1930, yes, by 1928.

A BAD START

IN CONTRAST with the conditions that have prevailed during the last two or three years, the railways are entering the winter this year with their tracks and structures in other than the best condition. This is in spite of liberal expenditures for their improvement during the last season. It is the result of the widespread and heavy rains of recent weeks which have not only washed out sections of many lines, but have also weakened the roadbed as a whole. As a result, the roads are not now in the usual good condition of maintenance and more than the normal amount of work remains to be done to get the tracks in shape to go into the winter. Furthermore, there are numerous evidences that the winter will be of more than normal severity. Because of these facts, it is highly important that every effort possible be made to bring the tracks up to as good a condition as possible before the ground freezes. This calls for concentration on those tasks that affect the condition of the tracks and structures, to the exclusion of those other important but less essential details. The roads are approaching the winter with a bad start and it is necessary to overcome this handicap as much as possible.

THE REQUIREMENTS ARE EXACTING

OF ALL the responsibilities placed on the officer in charge of railway structures, none is more trying or more fruitful of dissatisfaction than that of protecting bridges and other structures from the destructive action of locomotive gases. Judging from the report of the committee assigned to this subject, as reported at the Bridge and Building convention and abstracted elsewhere in this issue, progress in the solution of this problem is exceedingly slow. It has been shown that the action is appreciably intensified when the corrosive effect of the gas is supplemented by the cinder blast which wears away protective coatings, thereby exposing the metal surfaces to more ready action. However, thanks to the development of blast plates, reasonably effective protection from the erosive action of the cinder blast is now available. Unfortunately, the development of effective protection against corrosion is not so encouraging. That this is becoming a matter of serious import is indicated by the fact that the city of Denver has recently brought suit against a railroad to recover damages done to a city viaduct by locomotive gases.

Aside from the severe conditions imposed on the structure in service are the limitations which discourage thoroughly effective workmanship in the application of the materials designed to afford the necessary protection. It is hard to imagine any working conditions imposed on bridge and building forces more disagreeable than those to which they are subjected when working directly over the tracks where they are themselves subjected to the same gases and smoke which are responsible for the deterioration of the structure which they are trying to protect.

Because of these conditions, protective materials, such as concrete, have not always been of as high quality as would have been obtained under more favorable circumstances, notwithstanding the fact that there is no service to which concrete is subjected which makes high quality more imperative than where it must resist the sulphorous and sulphuric acids developed by coal smoke in the presence of moisture. It is not surprising, therefore, that concrete provided as a protection to structural steel under such conditions has sometimes failed miserably, but until it is known definitely that concrete of a maximum density, reinforced according to sound engineering principles does not give satisfactory service, it is unwise to assume that this material is ineffective in solving the difficult problem of protecting structural steel under these peculiarly adverse circumstances.

THE FIRST WINTER STORM

IS YOUR winter program ready? Will you be prepared to cope with the first storm when it appears? Have you an ample supply of snow shovels, torches, and other equipment in readiness for use on a minute's notice? Do your men know what is expected of them when a storm breaks or will they wait for instructions? These are highly important questions for consideration now while there is yet time to make good deficiencies in preparation. No one can forecast when storms will come. The only certainty is that they do come every winter. Therefore, the only safe course to pursue at any point where continuous operation is essential is to be prepared for the worst at any time. Executive ability is demonstrated by the extent to which unexpected troubles are anticipated. A test of a roadmaster or division engineer is afforded by the completeness with which he prepares for winter storms and the extent to which he is able to keep his tracks open and traffic moving under these adverse conditions.

CONTRASTING ATTITUDE TOWARDS CONVENTIONS

ONE LARGE central western road sent twenty of its men to the Bridge and Building Convention at Richmond; another sent thirteen; a third sent one; and a fourth large road was without representation. A far western road sent seven men from the Pacific coast to the convention, while another large road traversing the territory immediately adjacent to the convention was without representation. This indicates a wide difference in the attitude of the managements of these roads toward conventions and toward association work.

Among those roads which oppose, or at least do not encourage their men to attend conventions, it is maintained most commonly that the men are too busy or that the conventions are junkets. As to the first objection, there is no question but that conditions arise frequently which make it impractical for an individual man to leave his territory for a time. But this condition seldom applies to an entire railroad and never for one year after another. Where this objection is raised, it is, therefore, more properly an indication of a lack of appreciation of the value of association work.

In refutation of the idea that conventions are junkets, one need only refer to the recent meetings of the Roadmasters' and the Bridge and Building associations, where the members not only remained in the meetings throughout both morning and afternoon sessions, but also returned for evening sessions

at which technical programs were likewise presented for discussion. Such adherence to work has characterized meetings of these organizations for years and the programs have been criticised with some justification as being unduly exacting, and as not affording sufficient time for reasonable relaxation.

In contrast with the viewpoints of those roads which are not supporting the associations, attention may well be called to the fact that those roads which are now most largely represented have been so for years from which it is fair to assume that they have found the results beneficial or they would also have discouraged the attendance of their men. Furthermore, attention may be called to the fact that the two organizations in the maintenance of way field, other than the American Railway Engineering Association, have been continuously at work for 41 and 36 years respectively, and that they are today stronger and doing better work than at any time in their histories. The active cooperation that these organizations have received from men like R. H. Aishton, president of the American Railway Association, is also a tribute to their worth.

The reason why many roads encourage their men to attend these conventions year after year is because of the information and the enthusiasm that they derive from the exchange of experiences with men of similar responsibilities on other roads. It is an old and true saying that one gets out of any institution in proportion to what he puts into it. Thus, those who attend the convention, participate in the preparation of committee reports, and take part in their discussion, come to the meeting with a broader viewpoint and with more information gained from the experiences of others than can be secured within the right-of-way fences of one's own division. Furthermore, opportunity is offered through these agencies for the development of leadership which, if encouraged, will be reflected by more efficient work in the daily tasks of a man on his own road.

There is another consideration to be borne in mind. The American railways have made rapid progress in their development by reason of the independence of action and the varied approach to the different problems by men on various roads, combined with the free interchange of experiences through the medium of such organizations as the Roadmasters and the Bridge and Building associations. The greatest progress can be made in the future only through the continuance of such interchange. The late Julius Kruttschnitt repeatedly told officers on the roads under his supervision that these lines were debtors to the railways as a whole for much of the information they possessed and for many of the ideas they had put into practice and that they, therefore, owed it to the other roads to offer the results of their experiences freely for the common improvement of the industry. In keeping with this practice few roads take a more active interest in railway associations than the Southern Pacific, and it was this road that sent seven of its bridge and building men across the continent to attend that convention.

In brief, the railway associations have demonstrated their value in numerous ways. They are here to stay. Their influence is constructive. That road which is not participating in their work is withholding information that will be helpful to the industry as a whole. Even more, it is shutting its eyes to the benefits which are available for its men if it encourages them to participate in association activities, and is, therefore, the loser.

Letters to the Editor

EFFECT OF MODERN LOCOMOTIVES ON THE LENGTHS OF TURNOUTS

Reading, Pa.

TO THE EDITOR:

Referring to H. J. Pfeifer's article in the October issue of *Railway Engineering and Maintenance*, dealing with the effect of modern locomotives on the length of turnouts. No one could take exception to the various points brought out by Mr. Pfeifer except the one dealing with the gage of the track around sharp turnouts which he states is maintained at 4 ft. 8½ in. regardless of curvature.

His road must enjoy much less drastic restrictions as to the condition of motive power than we are obliged to contend with in the East, as we have found it impossible to keep long-wheelbase locomotives on the track through No. 6 turnouts and slip crossings unless the gage is increased in accordance with our standard rule as follows:

"When constructing new tracks or regaging existing tracks, the gage on tangents and curves shall, up to 5 deg., be 4 ft. 8 ½ in.

From 5 deg. to 7 deg.	4 ft. 8⅝ in.
From 7 deg. to 9 deg.	4 ft. 8¾ in.
From 9 deg. to 11 deg.	4 ft. 8⅞ in.
From 11 deg. to 13 deg.	4 ft. 9 in.
From 13 deg. and upwards	4 ft. 9⅛ in.

"Gage, including widening due to wear, shall not be permitted to exceed 4 ft. 9½ in."

R. BOONE ABBOTT,
Assistant General Superintendent, Reading.

New Books

Practical Track Work—By Walter F. Rench. 256 pages, 4½ in. by 7 in. Illustrated. Bound in fabricoid. Published by the General Publishing Company, 30 Church Street, New York. Price $2.

This book is essentially a treatise on the design and fabrication of trackwork insofar as this term implies the physical features of turnouts, crossings and all of their appurtenances including switch stands, frogs, guard rails, slips, etc. It also presents a fund of practical information on the methods of installing such equipment. The treatment differs from that of the usual textbook in that all of the equipment cited by way of example and explanation is that manufactured by the Ramapo Ajax Corporation for, as explained in the preface, the engineering department of that company participated in the preparation of the text. While this treatment imposes definite limitations on the scope of the work, the discussion of principles and practice is thoroughly general and covers the subject in a comprehensive way. The plan of treatment, which is identical in the various chapters on switches, frogs, crossings, etc., is to present an outline of the general principles and practical considerations controlling the design, followed by a description of the manner in which these requirements are met in equipment manufactured by the Ramapo Ajax Corporation, together with specific instructions covering the manner of installation.

HE LET IT BURN.—A Missouri court has held that a plaintiff, in an action for the destruction of fencing and pasture by fire started by an engine, was guilty of contributory negligence in making no effort to extinguish the fire other than to call up a roundhouse nearly a day after the fire was discovered.

What Is Being Done in the Way of Track Maintenance in Winter?

Investigation Shows That a Number of Important Roads Are Securing Advantageous Results From This Practice

ARE THE benefits to be gained by carrying on maintenance work on northern roads during the winter months greater than the handicaps imposed? This question is receiving increased attention and is being answered in different ways on various roads. The advantages to be gained if such work can be done economically are recognized to all familiar with the problems of maintenance and include the stabilization of forces, thereby avoiding an excessive labor turnover, which is not only costly but also slows up the work; the accomplishment of certain kinds of work during the winter months, thereby permitting a more orderly program for the work which can be done only in the summer, such as renewing ties, ballasting and surfacing, and the possibility of providing productive work for the forces which must be maintained on many roads during the winter to keep the lines open during heavy snow.

The stabilization of forces is a matter of extreme importance in meeting the changed conditions in the supply of labor with which the railroads are confronted. The practice of many laborers in former years of working on the track from spring to fall, finding other employment in the winter, and then returning to track work in the spring is no longer in vogue except in isolated parts of the country. Thus the railroads must now train a large proportion of their labor annually only to lose their investment in this training when the men are laid off for the winter.

Fluctuations in Maintenance Forces

The magnitude of this loss may be realized when it is stated that the spread between the maximum and minimum number of maintenance of way employees on the Class I roads in 1925 amounted to 101,839 men, or approximately 25 per cent of the maximum for that year. These figures apply to the country as a whole and it is probable that the spread on many northern roads greatly exceeded this ratio, since on many southern roads the forces are no smaller and in some cases are even larger in the winter than in the summer, due to the extreme heat of the summer and the more plentiful supply of labor in the winter, especially in the cotton growing territory. This spread, while large, is still a marked improvement over that of 1923, when it amounted to 144,558. Much of this reduction in 1925, is undoubtedly due to the growing practice of continuing work through the winter on the northern roads, which practice has been stimulated by the action of the Association of Railway Executives in appointing a committee in 1924 to consider means of stabilizing railroad employment to as great an extent as could be done economically.

The present immigration laws, which have reduced greatly the entry into this country of laborers from which the track forces were formerly recruited, have also rendered the securing of seasonal labor a matter of difficulty, although if this results in building up a permanent organization of intelligent workers it will prove a blessing in disguise. While track labor has always been regarded as unskilled it was never wholly so in fact and, with the introduction of labor saving machinery, it is becoming more and more necessary to have intelligent and experienced labor if the best results are to be obtained. Other advantages of a stabilized force include the less general need for camp cars and the more continuous use of certain work equipment throughout the year, thereby reducing overhead costs, the reduction in accidents due to the employment of inexperienced men and a reduction in the cost of many railway supplies for the practice of suspending all maintenance work in the winter has a tendency to impose fluctuations in the activities on the manufacturers and thus increase the overhead and add to the cost of their products. The effect of the successive peaks and depressions in the railway supply field due to seasonal railroad purchases has been studied by the Committee on Economics of Railway Labor of the American Railway

Widening Embankments in the Winter

Engineering Association and its report at the convention of 1925 indicates that the added cost amounts to as much as 10 per cent in some cases.

Effect of Winter Work on the Summer Program

Where winter maintenance work has been carried on it has been found to have a decidedly beneficial effect on the program for work during the open season. When rail is laid in winter the section forces are in position to put in their new ties as soon as weather conditions permit and to make a finished job, including ballasting or surfacing and the spacing of ties under the joints where it is the practice to do so, thus eliminating duplication of effort and permitting the use of smaller gangs during the summer months. It has also been found feasible to perform much ditching work in the winter and this, too, is reflected in a reduction of work which otherwise would be done in the summer.

The importance of providing productive work for the men that must be kept during the winter is not always recognized. The Baltimore & Ohio, which has adopted the practice of laying much of its rail in the winter by assembling its section gangs, found that while the unit cost of the work was slightly higher than for summer work, the total expenditure for track labor for the year on those sections of the road was less than formerly, indicating that the utilization for constructive work of the forces retained during the winter had not resulted in a corresponding increase in the payroll but primarily in the transfer of their activities between snow storms to productive operations.

Progress Being Made in Winter Work

Much progress has been made along these lines of late on a number of roads and the subject has been studied by committees of the American Railway

The Gangs Are Kept Busy When It Snows

Engineering Association and by the Roadmasters' and Maintenance of Way Association. The Committee on Economics of Railway Labor of the former association states as a basic principle that "It has long been recognized in industry that uniformity in the volume of work and continuity in operation are essential to the maximum efficiency and that as these decrease the cost of the work rises," and further that "The seasonal character of much maintenance of way work makes a uniform force impractical on many roads, particularly in the more northerly climates, although not to the degree commonly believed." The Committee of the Roadmasters' Association on the Re-arrangement of Track Work to Promote Uniform Forces Throughout the Year reported at the recent convention that "With the co-operation of a railroad management a uniform maintenance of way force the year round can be made a success where weather conditions permit" and listed the following items of work that can be carried on throughout the winter: (1) Spotting and distributing ties; (2) laying new rail and picking up old rail and scrap; (3) gaging track and applying tie plates; (4) tightening bolts; (5) tapping down spikes; (6) widening banks with cinders; (7) ditching, and (8) building fence.

To supplement the activities of these associations and to obtain a comprehensive view of the efforts being made in attacking this problem, a questionnaire was sent to 40 of the important roads in northern territory, embracing 170,000 miles of line, to ascertain the extent to which they are carrying out programs of winter work and the success with which these efforts are rewarded, together with other pertinent information on the subject, developed by their experience. Replies were received from 35 of these roads with a total of 155,300 miles of line.

The replies indicate that roads with approximately 87,500 miles of line are not attempting to do any track maintenance work during the winter, aside from shimming or other emergency measures except on those portions of the road where climatic conditions are favorable, such as on the Pacific coast in the case of the northerly transcontinental lines or in the southern territory on roads whose lines are located in both the north and the south. The Michigan Central the Pere Marquette and the Grand Trunk Western, which lie almost entirely in Michigan and roads with a considerable mileage in Wisconsin state the snow conditions in these states are so bad that little productive winter work can be done, although the Pere Marquette has laid rail in winter and has done other work at that season such as fence repairs, gaging track, burning right-of-way and distributing ties in the winter months with good results. This road has also found it practicable to keep a force of men on hand in one of its large terminals by furnishing them with bunk cars and fuel with the understanding that they are available for track work on the days when weather conditions permit such work and that they will respond to calls for emergency work during storms.

Roads Recognize Benefits to be Obtained

On the other hand the Boston & Maine, which maintains a considerable section force through the winter months to protect operation during times of heavy snow is contemplating a program of winter maintenance work to keep its men employed profitably between storms. The same consideration has led the Pennsylvania, the Lehigh Valley and the Buffalo, Rochester & Pittsburgh to adopt programs that can be carried on in cold weather. The Chicago, Rock Island & Pacific is now considering a program of winter work on its northern lines and recognizes the benefits to be gained by keeping the maintenance of expenditures as nearly uniform as possible throughout the year. This is being accomplished on its southern lines but in the north the number of men employed during seven months of the year is now about 50 per cent greater than during the five months which include the winter season.

Some roads which recognize the advantages of winter work are deterred from adopting the practice by the fact that their revenues are smaller in the winter than in the summer and on this account expenditures for maintenance are kept to a minimum during times of light traffic and are at a maximum during the late summer, with the result that the work is more costly, due to delays by traffic, and that the supply of labor is small, due to the number employed on highway construction, harvesting and other activities which are greater at that season than during the winter. They cite this as an argument in favor of the equalization method, so called, which permits the charging out of all or certain accounts in the maintenance allotment in equal amounts for each month of the year and believe that the adoption of this practice would enable the maintenance officer to take advantage of weather conditions, the labor market, track requirements and other factors to effect economies which are not possible under the present practice.

In listing the work that is being done in winter the laying of rail easily takes first place, together

with such allied activities as renewing frogs and switches, tightening bolts, gaging track, applying tie plates and renewing angle bars and bolts where necessary. While ice and snow on the ties and the base of the rails sometimes handicap the work it has been found that the use of flangers and of work train engines equipped with steam pipes for melting the snow add little to the cost and do much to facilitate the work. The removal of ballast from the ties and around the base of the rails can be done by the section men before the advent of freezing weather, at no extra expense since it will have to be done in any event. Indicative of the change brought about by the practice of laying rail in winter it is interesting to note that orders for approximately 800,000 tons of rail were placed during the first half of the last month for the coming year's requirements, whereas only a few years ago no large orders for rail were placed before the first of the year.

The Lehigh Valley may be considered the pioneer among northern roads in the winter laying of rail as for the last 17 years it has endeavored to lay all of its new rail during that season, and usually has been able to do so, its few failures being due to inability to obtain delivery from the mills in time to permit it to carry out its program. After the rail is laid it makes the necessary adjustments to obtain the proper bearing of the rail on the ties and does the necessary gaging during cold weather so that this work will not delay the gangs putting in ties and surfacing during the spring and summer. This road has found an added advantage in winter rail laying in that it permits the early installation of its relay rail in secondary lines and branches. Since the greater portion of the Lehigh Valley lies in northern Pennsylvania and Western New York it may be classed as a northern road and its success in carrying this work successfully during the winter season is all the more significant.

The Baltimore & Ohio is another road that finds it advantageous to lay rail in the winter by assembling its section gangs and doing the work on days when conditions are favorable. In this way it keeps its men engaged in productive work and clears the way for tie renewals, surfacing and ballasting early in the open season. Like the Lehigh Valley it also finds a further advantage in the early laying of its relay rail which this practice makes possible. A number of the roads laying rail in winter cite the fact that the line and surface are usually at their best at that season of the year due to the fall work in preparation for winter.

The Northern Pacific, one of the most northerly transcontinental lines in this country, reports that last winter it laid a total of 84 miles of new rail in North Dakota, Montana and Idaho and that the work was carried on in a satisfactory manner, making possible the completion of a rather ambitious program of rail relaying and ballasting for the current year. Weather conditions were favorable for the work where ordinarily the snow and cold weather in those states would render the work impossible. The officers of this road feel that it would not be advisable to adopt a program calling for the relaying of all of the rail in this territory in the winter but rather that advantage should be taken of such opportunities as are afforded by open winters, since the supply of labor is usually plentiful in the Northwest at that season while the traffic is materially lighter than during the summer months.

The Union Pacific system also reports laying considerable rail during the last winter with satisfactory results. Among other advantages, a plentiful supply of labor, together with light traffic, resulted in a greater man-hour production than is possible during the summer months. Other roads reporting favorably on the practice of laying rail in winter include the Pennsylvania, the Illinois Central, the Norfolk & Western, the Cleveland, Cincinnati, Chicago & St. Louis, the Chesapeake & Ohio, the Southern Pacific (Pacific System), and the Chicago & Alton, the Illinois Central stating that about 26 per cent of its new rail is laid in the winter, of which the greater portion is on its northern lines.

Ditching and Other Work in Winter

Other winter work includes ditching and other drainage improvements and the Buffalo, Rochester & Pittsburgh devotes much attention to this. It maintains a certain force, both section men and extra gangs to handle snow, ice, etc., and in order to keep the men busy when not engaged on this work, it prepares a program of laying tile drains in cuts, cleaning old ditches, making new ditches, and removing overhanging rock and loose material from cuts. During the winter of 1925-1926 the track forces cleaned out 88 miles of roadbed and surface ditches and made 17 miles of new ditches. A weekly blue print chart is issued showing the old ditches cleaned out and the new ditches made on each section, with totals for each division, as a means of stimulating competition.

Fence building and repairs are carried on by a number of roads, some stating that it is only done where new posts are not required, while others, notably the Lehigh Valley and the Delaware, Lackawanna & Western, report that considerable fence building is accomplished by the use of steel posts which require no digging and which can be installed almost as easily in the winter as in the summer. Other miscellaneous work, such as widening banks with cinders, dressing rock cuts to increase clearances, distributing ties for the coming season's requirements and distributing cinders for ballasting branch lines is done on a number of roads.

River Revetment Work on the Northern Pacific

The Northern Pacific has, since 1918, employed extra gangs from its summer track forces for special revetment work along the Yellowstone River during the winter. Last winter this work included the quarrying of approximately 12,000 cu. yd. of riprap and the placing of the stone along the river bank where it is near the roadbed. During February the left bank of the Missouri River above the Bismarck bridge was protected with a woven willow mattress 60 ft. wide by 1 ft. thick, weighted with 1,100 cu. yd. of one-man and two-man stone. During the winter of 1923-1924 a similar revetment 5,000 ft. long and containing 8,900 cu. yd. of stone was placed along the right bank of the river above the Bismarck bridge and a similar mattress 1,500 ft. long with 3,700 cu. yd. of stone, was placed along the same river on a branch line.

The placing of these revetments demonstrated that the work could be done much more cheaply in the winter than in the summer, since the mattress could be woven on top of the ice and then sunk by dynamiting the ice beneath it. The ability to handle the material with sleds and the availability of teams at this season of the year also contributed to the economy of the work.

Practice varies quite sharply as to the use of section men or extra gangs for laying rail or other work which requires large gangs. Many roads, notably the Lehigh Valley, the Pennsylvania, the Baltimore & Ohio, the Chesapeake & Ohio and the Southern Pacific feel that the best results are to be obtained by assembling section gangs for this purpose, since this practice provides work for men whose time must be paid for in any event ,and in some cases, permits the maintenance of larger gangs than would otherwise be possible, thus retaining a larger proportion of experienced men. The general use of motor cars makes possible the assembling of the gangs easily and at little cost. The Illinois Central also uses section men for laying rail to a great extent but uses extra gangs also at times.

The Chesapeake & Ohio carries on its winter rail laying with both section and extra gangs, but makes an effort to keep a reasonable force on the sections and to do all the work possible with section gangs. Its experience gained from following this practice since 1923 indicates that there is economy in doing a certain amount of work in the winter months which permits practically uniform section forces throughout the year. Thus on sections where it is the custom to work eight men during the summer months it is possible to get productive work out of five or six men in the winter and thereby retain a force of men who become valuable employees from the fact that they gain in experience and appreciate continuous employment. By this practice that road is now working about 60 per cent of its normal summer force during the winter months instead of about 40 per cent as formerly. It has found one objection to the use of extra gangs for winter work in the tendency of foremen to attempt to work on inclement days when efficient results cannot be obtained, in order that the men can make their time, thus increasing the cost of the work materially, especially in the case of large gangs. On the other hand the Norfolk & Western, which has followed the practice of laying rail in the winter for the last three years, uses extra gangs for the work on all but one of its divisions and finds this plan satisfactory due to the fact that it provides well organized gangs the year round. Since the rail is laid in the winter the rail gangs are available for ballasting with the advent of spring, insuring that the work can be completed in ample time before cold weather. Its program is so arranged that the work on the more northerly lines is done in October and November, the gangs then working south where less severe weather conditions will be encountered. Other roads using extra gangs for rail laying include the Union Pacific, the Northern Pacific, the Cleveland, Cincinnati, Chicago & St. Louis, the Chicago & Alton and the Hocking Valley.

Special Winter Conditions on the Southern Pacific

The Southern Pacific (Pacific System), while not coming specifically in the category of northern roads, has a winter problem of its own. Its lines extend from Portland, Ore., to the southern end of California and thence east through the southern portions of Arizona and New Mexico, to El Paso, Tex., and north to Dawson, in the northeastern part of New Mexico, as well as main lines from San Francisco, Cal., to Ogden, Utah. Since the greater portion of the road lies in a mild climate where ordinary maintenance work can be carried on the year around the only places where the question of winter work need be considered is in the Sierra Nevada mountains, the Siskiyou mountains in Northern California and the mountains of Northern New Mexico, where for short periods the temperature falls to as low as 20 deg. below zero. In contrast, in the interior valleys of California and Arizona it is desirable to do as much maintenance work as possible during the winter months to avoid the heat of the summer which is severe in the desert territory. In these regions, as well as in the moutainous districts, traffic is heavy in the summer months, while labor is scarce. In the Sierra Nevada mountains the last winter was very mild and open during the greater part of the season so that tie and rail renewals could be handled without difficulty. New rail was laid in this territory and also on the Salt Lake division with good results, both as to quality and cost. The redecking of the single track portion of the Salt Lake trestle was completed during the winter and the work was carried on to better advantage than during the previous summer. As far as practicable section gangs are used for track work during the winter as the men are better equipped, better protected with proper clothing and better organized to meet the conditions.

Cost and Quality of Winter Work

Opinions differ as to the cost and quality of winter work, although it appears significant that many of the roads that have gone into the matter thoroughly are satisfied that both of these factors compare favorably with work done during the summer, while others feel that while the costs are perhaps somewhat higher in the winter this is more than offset by the other advantages gained. The Chesapeake & Ohio reports that there is only a small increase in the cost, but that the quality is not as high as is secured in the spring and fall, due often to the endeavor of large gangs to make rail laying records when weather conditions are not favorable to satisfactory work. It feels, however, that these disadvantages are more than offset by other considerations. The Northern Pacific and the Union Pacific report that their costs of laying rail in the winter are lower than in the summer months while the quality of the work is satisfactory. On both of these roads traffic in the winter is lighter than at other seasons of the year, while labor is more plentiful due to the heavy demands for harvest labor during the summer. The Union Pacific states that the average man-hour output in winter rail laying is about 20 per cent higher than is secured at other seasons and almost double that of work done during August, September and October when the traffic movement is at its peak. As has been seen, the Northern Pacific also effects marked economies by carrying on its river revetment work during the winter months.

The Illinois Central reports that both the cost and quality of rail laying in the winter are about the same as in the summer, notwithstanding its heavy coal traffic in the winter. The Southern Pacific, the Baltimore & Ohio, the Delaware, Lackawanna & Western, the Norfolk & Western, the Chesapeake & Ohio and the Chicago & Alton are among other roads which find little difference in either the cost or quality of winter work compared with that done in summer. On the other hand the Minneapolis, St. Paul & Saut Ste. Marie finds that the cost of winter work is much higher and the quality decidely lower. The Chicago, Burlington & Quincy reports that while the quality of winter work is the same as that done in other seasons, the cost is always higher due to the precautions taken to secure that quality and for that reason winter work is seriously handicapped.. It finds it practicable, however, to carry the building up of battered rails and frogs by welding throughout the year. The Great Northern, the Chicago, Milwaukee & St. Paul and the Grand Trunk Western

report that costs are somewhat higher and the quality somewhat lower and for these reasons no winter work is attempted except when necessary or when advantage can be taken of favorable weather conditions.

Winter Work on Bridges and Buildings

A number of roads are carrying on considerable bridge and building work of various kinds in the winter, the New York, New Haven & Hartford stating that it has nearly stabilized its forces in this department by this procedure. The Canadian National makes it a practice to construct the concrete foundations of its larger bridges during the winter season, since the freedom from high water at that time more than offsets the extra expense of protecting the concrete from freezing results in materially lower costs. It also feels that much work can be done on its large mileage of timber trestles in the winter, thus furnishing steady employment for its experienced bridge men. The Great Northern, in the extremely northern part of this country, carries on bridge work in winter where the temperature does not fall below zero and states that the results are fairly economical. Other roads doing bridge and building work during the winter season include the Chicago, Burlington & Quincy, the Chicago, Rock Island & Pacific, and the Southern Pacific. The Buffalo, Rochester & Pittsburgh and the Grand Trunk Western usually confine their winter bridge work to the repair or rebuilding of wooden trestles. Inside painting is done by the Pennsylvania and the Chicago, Rock Island & Pacific, while the Lehigh Valley carries on the raising of bridges and the cutting back of structures to provide increased clearances.

The advantages and disadvantages, as given in the various replies, may be summarized as follows:

Advantages

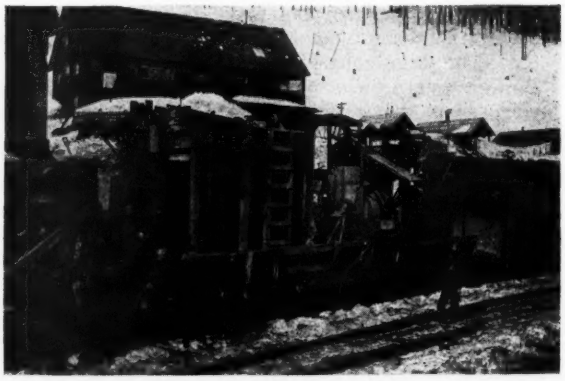
(1) Stabilization of forces resulting in:
  (a) Decreased labor turnover.
  (b) Retention of experienced men.
  (c) Better morale due to continuous employment.
(2) Work performed in winter permits:
  (a) More time to be devoted to other work in summer.
  (b) Earlier completion of ballasting, tie renewals and surfacing.
(3) Greater efficiency of labor, due to:
  (a) More plentiful supply, permitting wider range in choice of men.
  (b) Greater output due to desire of men to keep their jobs.
  (c) Conditions more conducive to physical exertion.
(4) Less delay by traffic.
(5) Costs lower than for same work in summer.
(6) Provides productive work for forces that must be retained.
(7) Organized forces available for emergency work in snow storms.
(8) Better opportunity for providing the proper expansion in laying rail.

Disadvantages

(1) Less efficient labor due to:
  (a) Unpleasant working conditions.
  (b) Heavy clothing hampers free movement of men.
  (c) Inability to keep men employed continuously.
(2) Delays due to increased traffic.
(3) Costs higher than for same work in summer, due to:
  (a) 1 and 2, as above, tendency of foremen to attempt work in inclement weather to permit men to make their time, and to greater amount of work necessary to secure the proper quality.
(4) Quality of work lower than that done in summer.
(5) Difficulty in providing the proper expansion in laying rail.

From this it will be noted that there is a sharp division of opinion based on the experience of different roads as to the results of winter work, especially as to the efficiency of labor at that season, delays by traffic and the cost and quality of the work. These factors are more or less interlocked and the diametrical differences in results often caused by local conditions due either to the nature of the traffic on the individual roads or to their geographical locations which cause wide variations in the labor market. It may be said that all maintenance men appreciate the advantages to be gained if winter work can be carried on economically but the difficulty in many cases is to secure that economy which will make the plan successful. There are many intangible advantages, to be sure, but such a radical change in program for many roads will be judged by its tangible results alone and these must be secured if the plan is to be a success. That such results have been attained in many instances should be an incentive to others to renew their efforts to find some way to increase the amount of work to be done by track men during the winter months. Some of the difficulties encountered in winter work may be lessened by performing certain parts of the work in the open season. Thus, some roads report that the laying of new rail is rendered difficult by the frozen ballast around the rail in the winter; this is obviated on other roads by removing such ballast in the fall, and as the work must be done in any event the cost is no more than if the rail were laid in the summer. Again, if proper provision is made of expansion appropriate to the temperature this item should entail no more difficulties in the winter than it would in hot weather.

In inaugurating the practice of winter work a program must be worked out carefully beforehand and careful supervision must be maintained to insure that the work is carried on in the proper manner. Ordinarily it is better to start in a small way in order that



A Concreting Outfit for Winter Work

the possibilities may be studied, since in that way the work may be expanded easily, while the loss will be less if for any reasons it develops that the plan is not feasible where the experiment is tried.

The extent to which winter maintenance work may be increased is usually a matter of development based on experience as is indicated by the fact that the roads who have done such work the longest are the ones who are performing the most varied kinds of work during the winter season. In adopting any radical inovation there is always a certain amount of inertia to overcome and it usually found that this can be done by attacking one particular class of work first and extending the activities as experience is gained. The favorable results secured on many important roads demonstrate that valuable advantages may be gained where intelligent and well thought out plans are used for the solution of the problem.

Fewer Ties Treated in 1925

ALTHOUGH there was an increase in the treatment of timber during 1925 as compared with 1924 to the amount of 5,891,303 cu. ft., there was actually a small reduction in the treatment of railway cross ties, the number of cross ties treated in 1925 being 62,563,911 as compared with 62,632,710 cross ties in 1924. However, as there was a decrease of about 10,000,000 in the total number of ties purchased by the railroads in 1925 as compared with 1924, it is safe to say that there was a net increase in the percentage of cross ties subjected to treatment in the later year.

Statistics of the production and consumption of treated timber, prepared by R. K. Helphenstine, Jr., for the United States Department of Agriculture Forest Service, and the American Wood Preservers' Association, show that the increase in the treatment of timber occurred entirely in three classifications of timber recognized in these statistics, namely construction timbers, poles and cross arms. The largest increase occurred in poles, 42,204,413 cu. ft. being treated in 1925, or an increase of 5,487,745 cu. ft. as compared with 1924. In the case of construction timbers, 27,992,452 cu. ft. were treated in 1925, an increase of 3,701,221 cu. ft. over 1924. The treatment of cross arms in 1925 totalled 621,705 cu. ft. or 103,894 cu. ft. more than the total in 1924. In addition to the minor reduction in the case of cross ties, there was a reduction of 2,049,009 cu. ft. in the case of piles, 783,071 cu. ft. in the case of wooden blocks, and 362,980 cu. ft. for miscellaneous materials.

Wood Preservation, 1909-1925, Together With Consumption of Creosote and Zinc Chloride

Year	Total Material Treated Cu. Ft.	Number of Cross Ties Treated	Creosote Used, Gal.	Zinc Chloride Used, Lbs.
1909	75,946,419	20,693,012	51,426,212	16,215,107
1910	100,074,144	26,155,677	63,266,271	16,802,532
1911	111,524,563	28,394,140	73,027,335	16,359,797
1912	125,931,056	32,394,336	83,666,490	20,751,711
1913	153,613,888	40,260,416	108,378,359	26,466,803
1914	159,582,639	43,846,987	79,334,606	27,212,259
1915	140,858,963	37,085,585	80,859,442	33,269,604
1916	150,522,982	37,469,368	90,404,749	26,746,577
1917	137,338,586	33,459,470	75,541,737	26,444,689
1918	122,612,890	30,609,209	52,776,386	31,101,111
1919	146,060,994	37,567,927	65,556,247	43,483,134
1920	173,309,505	44,987,532	68,757,508	49,717,929
1921	201,643,228	55,383,515	76,513,279	51,375,360
1922	166,620,347	41,316,474	86,321,389	29,868,639
1923	224,375,468	53,610,175	127,417,305	28,830,817
1924	268,583,235	62,632,710	157,305,358	33,208,675
1925	274,474,538	62,563,911	167,642,790	26,378,658

Statistics on the consumption of preservatives for 1925 confirm the prevailing tendency of a greater use of creosote and a decreasing use of zinc chloride and miscellaneous preservatives. A total of 167,642,790 gal. of creosote was used in 1925, or an increase of 10,337 432 gal. over 1924, while the consumption of zinc chloride in 1925 was 26,378,658 lb., or a decrease of 6,880,017 lb. as compared with the previous year. Miscellaneous preservatives totalled only 331,591 gal. in 1925, while paving oil was used to the total of 2,080,287 gal. The use of petroleum oil as an admixture in treatment amounted to 13,048,539 gal., or an increase of 1,869,193 gal. over the total in 1924.

A new feature of the statistics is a statement of the amount of car material treated, which was 48,380 board feet during 1925. Other items of miscellaneous material treated include 2,104,500 board feet of fence posts, 1,317,811 board feet of tie plugs and 855,000 board feet of crossing planks.

Cross Ties Treated by Kinds of Woods and Kinds of Preservatives, 1925

Preservatives	Oak	Yellow pine	Douglas fir	Beech	Gum	Birch	Tamarack	Western yellow pine	Maple	Hemlock	Lodge-pole pine	Elm	All other	Total
Creosote*	18,200,116	11,825,575	361,812	1,671,939	2,002,320	349,620	22,326	.....	765,934	.....	.....	.....	622,328	35,821,970
Creosote-petroleum†	1,064,011	2,631,372	2,354,965	178,427	839,664	1,004,536	496,823	295,159	137,156	15,090	157,908	7,638	46,850	9,229,599
Zinc-creosote‡	2,163,905	842,531	.....	489,949	13,903	124,290	100,000	46,155	131,368	9,104	8,205	52,068	78,528	4,060,006
Zinc chloride	2,420,754	933,448	3,130,702	1,066,994	456,304	750,832	1,540,115	1,485,308	719,405	475,256	151,789	12,500	240,022	13,383,429
Miscellaneous	.....	.....	12,411	.....	.....	.....	.....	56,496	.....	.....	.....	.....	.....	68,907
Total	23,848,786	16,232,926	5,859,890	3,407,309	3,312,191	2,229,278	2,159,264	1,883,118	1,753,863	499,450	317,902	72,206	987,728	62,563,911
Per cent of total	38.1	25.9	9.4	5.4	5.3	3.6	3.5	3.0	2.8	0.8	0.5	0.1	1.6	100.0

* Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution.
† Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution in mixture with petroleum.
‡ Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution in mixture with zinc chloride.

Bureau of Safety Reports on Several Serious Derailments

AMONG recent reports issued by the Bureau of Safety of the Interstate Commerce Commission on railway accidents involving fatalities, were three in which the condition of the track structure or other circumstances entered for which the maintenance of way department was directly responsible. Another, the disaster on the Denver & Rio Grande Western near Waco, Colo., while definitely ascribed to excessive speed, raises some pertinent points with respect to super-elevation. The reports on these four accidents are reviewed in brief below.

Excessive Speed on Curve Derails Train

According to the conclusion of the Bureau of Safety of the Interstate Commerce Commission, the derailment of eastbound passenger train No. 2 of the Denver & Rio Grande Western on the night of September 5, which resulted in the death of 27 passengers and 2 employees and the injury of 54 other persons, was clearly the result of excessive speed (from 40 to 45 miles per hour) on an 11-deg. 30-min. curve. There was no evidence to indicate that the track was in any way defective but the report comments at some length on the fact that the super-elevation provided, 4 in., was less than the theoretical elevation prescribed by the American Railway Engineering Association. The portion of the report covering this point is as follows:

"While it is the practice of the engineering department to limit the elevation of such curves to 4 in., yet according to the recommended practice of the American Railway Engineering Association, the theoretical elevation on a curve of 11 deg. 30 min. for a speed of 30 miles per hour would be 6.81 in., and while it cannot be said that with an elevation of 4 in. instead of 6.81 in. there would be serious danger of the overturning limit being reached, yet it is clearly apparent that the speeds allowed cannot be exceeded without approaching the danger point for a curve of such a high degree."

In the conclusion, further reference is made to the matter of super-elevation in the following words:

"It is well recognized that in mountain territory where there are many heavy grades and sharp curves it is desirable to keep down the amount of elevation on curves in order to facilitate the movement of heavy trains when ascending grades. This require-

ment, however, has a very necessary corollary which is even more important and that is that trains capable of moving at high rates of speed shall not exceed the limits beyond which they cannot go with any reasonable degree of safety, in view of the limited elevation provided. If the desire to expedite the handling of heavy tonnage trains is paramount, resulting in low elevation on curves, then it is necessary very materially to restrict the speed of passenger trains when rounding such curves."

Hand Car Taken by Boys Derails Train

On August 25, an extra freight train on the Atchison, Topeka & Santa Fe, collided with a hand car and was derailed, near Thoreau, N. M., killing 2 men and injuring 12 others. The reason for the large number of casualties is that the train was pushing a bridge pile driver outfit ahead of the locomotive, which outfit included seven bunk cars occupied by members of the bridge and building crew.

At the time of the accident the hand car was in the possession of three boys, 11, 13 and 15 years of age, who had taken it without permission from an extra gang employed in the vicinity. The accident occurred about midnight, and according to the boys, was due in large part to the fact that no headlight was visible because the bridge outfit was being pushed ahead of the locomotive. They had, however, succeeded in getting all but one wheel of the hand car off the track before it was struck.

In the investigation, the foreman of the extra gang, who had been in charge of the gang as a relief foreman, for only a short time, testified that he had endeavored to obtain some locks and chains for the purpose of locking up the hand cars assigned to the gang when they were not in use, but that he had been unable to find any and was told that they would have to be ordered in the regular routine and could not be delivered for several weeks. In the conclusion, of the report made by the Bureau of Safety of the Interstate Commerce Commission, attention is called to the necessity for keeping hand cars locked when not in use, and to the dangers attending the handling of cars in a train ahead of the locomotive.

Poor Flagging Results in Fatal Derailment

On August 12 a freight train on the Louisville & Nashville was derailed near Drivers, Ill., at a point where a rail had been removed while a track gang was renewing rail. The accident occurred at 2:45 p. m. but there was a severe rainfall at the time and testimony at the hearing indicated that it was difficult to see any distance. The section foreman in charge of the rail laying testified that he had sent out flagmen in each direction, equipped with flags and torpedoes before removing any rail. Both the fireman and engineman of the freight train were killed as a result of the accident so it was impossible to determine definitely whether either member of the engine crew noticed the yellow caution board placed 5,810 ft. from the point of the derailment or the red flag on a staff which the flagman had placed at a point 3170 ft. from the point where the rail was being changed out.

Upon having his attention called to an unexploded torpedo with the clips broken off, the flagman stated that it was the torpedo which he had placed on the rail and that it was in that condition when he had done so, but that he did not suppose that it would fall off the rail before the leading wheels of the engine would reach it and cause it to explode. He also said that when he failed to get a whistle acknowledgement to his stop signal, he attempted to remove the flag from the staff and wave it but did not succeed in doing so until after the engine had passed him. In the conclusion of its report, the Bureau of Safety of the Interstate Commerce Commission held that the accident was primarily the result of the carelessness and inattention of the flagman. It also called attention to the responsibility of the railroad in providing flagmen with adequate equipment and for maintaining fully as high a standard of duty and responsibility for maintenance of way flagmen as exists with train flagmen.

Defective Switch Causes Fatal Derailment

Because a section foreman on the Long Island failed to make sure that the nut which secured the connecting rod of a switch to the switch stand was securely in place, the nut dropped off and allowed the switch points to open slightly, with the result that a fast. passenger train was derailed, killing a fireman and an engineman and injuring 21 passengers and 7 employees. This is the conclusion reached in the report of the Bureau of Safety of the Interstate Commerce Commission on a derailment occurring on the Long Island at Calverton, N. Y., on August 13.

In this switch stand, which had been in service approximately 40 years, the target shaft is bent at the bottom to form a crank which extends downward through the eye-hole of the connecting rod, the connecting rod being held in place by a washer and a nut. In addition, there is a hole through the threaded portion of the crank near the bottom, to receive a cotter pin intended to keep the nut and washer from working off. After the accident the switch lever was found to be locked for main track movement and the target displayed the proper clear indication, but the nut and washer were found lying on the ground directly under the connecting rod which had been allowed to drop off the end of the crank. No cotter pin or nail designed to serve the same purpose were found in the vicinity of the nut and washer.

The section foreman stated in the examination that he had examined the switch three days before the accident and had found the nut and washer in proper position and screwed up tight. Both he and supervisor knew of no instances of switches having been tampered with in the vicinity of the accident.

Closer examination of the switch showed that the hole provided to receive a cotter pin or nail was clogged with dirt and grease so that it is certain that no cotter pin or nail had been passed through this hole for a considerable time previous to the accident. Furthermore, the nut was covered with grease and dirt, proving beyond any question that no one had placed a wrench over the nut for the purpose of either tightening or untightening it for some time prior to the accident. An examination of the inside of the nut showed that the threads in the lower half of the nut were filled with a deposit of grease and dirt, thus demonstrating that the nut had been screwed only half way on the crank for some time previous to the accident.

The conclusion based on this evidence is that the nut had gradually worked off and that for some time previous to the accident had received so little attention that only two or three threads kept it from falling off. The section foreman was held primarily responsible, but the report also calls attention to the improper condition of other switches on the line as "indicating a laxness in the maintenance of switches as well as in the supervision and inspection of the same."

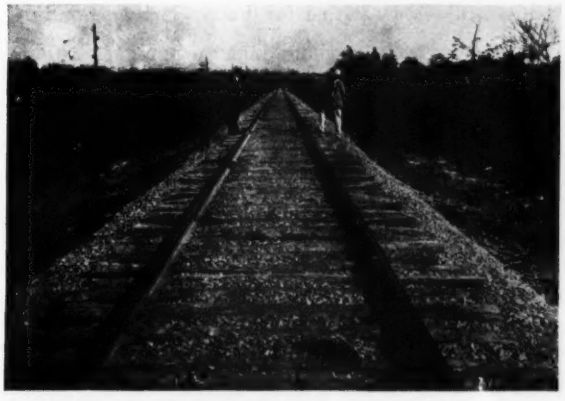
How the Railway Lines of Cuba Are Maintained

Wide Differences in Customs of Living Lead to Marked Deviations from American Practices

By BEN B. SHAW

[*Although only 80 miles of water intervenes between the railways of Cuba and those of the United States, they differ widely in many respects in the methods employed in their maintenance. The railways of Cuba comprise approximately 2,500 miles of lines, of which the largest properties are the Cuba Railroad with more than 750 miles of lines, the Cuba Northern with 204 miles of lines, and the United Railways of Havana with a total of 1,250 miles of lines. The author of this article was a division engineer on the Chicago, Rock Island & Pacific prior to his appointment as chief engineer of the Cuba Railroad in December, 1922, which position he resigned late in 1925 to return to the United States.*—EDITOR.]

THE MAINTENANCE of the roadway and structures on the Cuba Railroad is handled by a departmental organization with the chief engineer responsible for results. Responsibility for the successful performance of the forces is allocated by him to the sub-department heads, with the office engineer directing the strictly engineering work, the bridge engineer in charge of the design, construction and maintenance of all bridges and buildings, the general supervisor handling the straight track maintenance and the construction of new and the extension of old secondary tracks, and the engineer of oil and water service supervising the construction and maintenance of all oil and water stations. The position

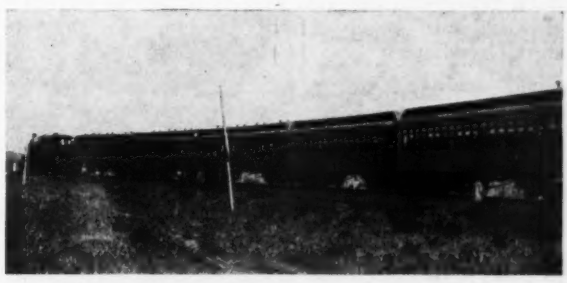


Typical Ballasted Track Showing Roadbed Section

of construction supervisor is filled only when construction work of sufficient magnitude is under way to warrant the expense.

The actual engineering work is carried on with the greatest care, for it is necessary to supply the Cuban Railroad Commission with information in more detail than is required in the United States. All plans have to be filed with the commission before work is begun. Every new proposition, no matter how small, requires an engineer's report and the skill and care displayed is comparable with that shown on any other railroad. The engineers are both American and Cuban.

The year in Cuba is divided into two seasons, the dry and the wet. The dry season starts about the middle of December and lasts until the middle of May. During the dry season the "Zafra" or sugar cane harvest is on, at which time the business on the railroad is at the peak, as many as 40 trains be-



A Typical Passenger Train On the Cuba Railroad

ing handled on some territories in 24 hours, making it difficult to secure work train service. During the wet season more power and equipment are available and labor is easier to secure, but as it rains almost every day it is a poor time for economical maintenance work. These conditions materially affect the cost of maintenance and construction work and cannot be appreciated unless experienced.

The problem of track work is to build up a track structure in keeping with the power and equipment. Standard A. R. E. A. designs have been adopted for track fastenings, frogs and switches, and with the use of heat-treated oil-quenched angle bars and bolts, together with heavier frogs and switches, riding conditions have been improved, the track made stronger and in the end maintenance expenses lowered. The action of the salt-laden atmosphere on angle bars, bolts, spikes and all metal, is so rapid as to necessitate a constant renewal of track fastenings and a liberal use of paint on bridges and buildings to protect them from corrosion. Proper maintenance requires painting every two years.

Use Ties Made From Very Hard Woods

The ties used are of native hard wood, purchased locally under grade "A" specifications of 7 in. by 9 in. by 8 ft. 6 in. dimensions. The fibre of the native hard woods is so dense that they will not float in water and they are so hard that holes must be drilled before driving spikes. Some of the better grade of native ties last 20 to 25 years in the track. However, this is only true of certain hard woods, for some of the native woods last only two or three years, comparing favorably with the length of life of untreated

long leaf pine shipped to Cuba from the United States.

The sections vary in length but average about 12 kilometers, or 7 miles, long. The company furnishes quarters for the foreman and the laborers. The section houses are a combined foreman's house and bunk house with a kitchen connecting the two. On both extra and section gangs, the foremen are allowed to board and supply the men and the company protects them by board deductions.

The securing of proper labor for section and extra gang work is a difficult problem. A large percentage of the men no sooner become acquainted with their work than they leave for the sugar mills. Most of the foremen are Spaniards and originally the men were, but of late men of all nationalities are coming to the island. As a result there are gangs of Hindus, Germans, Spaniards, Russian Jews, Poles and a few each of French, Chinese and Jamaica negroes. This influx to the island is induced by the short distance to the United States. Most of the men have had no track experience and only plan to remain in this class of work until an opportunity develops for them to start elsewhere.

Men Oppose Improved Tools

In the United States it is not much of a task to change from one class of tool to another or to revise the mode of doing work, but after several years of American supervision of the Cuba Railroad the grass is still cut with a machete rather than a scythe, although the latter is the more efficient. To illustrate further, it had been the practice to use only round-pointed shovels for track work and when square shovels were furnished it was only a short time until cold chisels were busy and the shovels were pointed again. Again, the men will not sleep in bunks but insist on hammocks. In certain instances where they were provided with newly fitted bunk cars, these bunks disappeared within a few days and hammocks appeared in their place.

Heavy jobs, such as rail-laying, ballasting and all construction work is handled by extra gangs, but straight maintenance work is taken care of by section gangs. On rail relay jobs the work is handled the same as in the United States other than that the ties are drilled for the spikes.

On ballast work line and grade stakes are set. On tangents the line stakes are placed opposite each telegraph pole, but as the curves are spiraled, stakes are set at each spiral point and at each curve point on the simple curve. The grade stakes on tangent are set on one side only, but on curves on both sides, so the engineer's stages provide the proper super-elevation.

How Ballasting is Done

The ballasting work is done with extra gangs, averaging 60 men. On a heavy ballast job the work consists not only of ballasting, but it means the virtual rehabilitation of the entire territory to be ballasted. On this class of work several gangs are used, the number varying with the condition of the roadbed. The first gangs renew and space the ties, skeletonize the track and take care of all sub-raises; in fact, they fully prepare the subgrade for the ballast rock. Two ballast gangs are then used, the first gang making the first raise and the second gang making the second raise. Twelve men and an assistant foreman of the second gang follow the main portion of the gang, dressing and finishing the track.

Suitable ballast is very costly. There are good deposits of ballast rock on the island, but only one company quarry has been developed on the Cuba Railroad and this is near Santiago. Track ballasted with rock from this crusher is as good as found on any railroad, although it looks different. In the accompanying illustrations showing some of this track it is seen that the dirt dressing section is used instead of the boxed-in ballast section. This is done to prevent horsemen from using the railroad as a bridle path, which is the general practice in Cuba. Other than the above mentioned rock the only material available for ballast is serpentine, which is very short lived.

Drainage is Important

With a precipitation of 52 in. in seven months good drainage is of the utmost importance. To improve the drainage steam ditchers and a ditcher spreader are used. As a heavy program of passing track extensions and new passing and yard track construction has been in progress in recent years, cuts have been cleaned out with the ditchers and the new fills made with this material. In some locations where the country is so flat that it is difficult to secure drainage by the use of the machines, contracts have been let for hand-excavated ditches.

During the construction of the lines a great number of pile trestle bridges were built that provided more opening than was necessary to handle the water from their respective water sheds. As timber is short lived in the climate of Cuba, the maintenance costs ran so high that many of these pile trestles have been replaced with concrete boxes and filled, the filling being loaded with steam ditchers and steam shovels. Two ditcher trains are operated regularly, each train working two ditchers and four air dump cars. When steam shovels are used for bridge filling, trains of air dump cars are also used.

New Bridges Designed for Fairly Heavy Loading

On the main line the standard for new steel bridges is Cooper's E-50 loading, replacing the old standard of Cooper's E-34. In general native piling and bridge timbers are used but on some work where the entire structure will require replacement within the next two or three years, repairs are made with fir caps and stringers. Creosoted piling is used for repairs on the wharfs in salt water. The Spaniard is skilled, although slow, in his masonry, carpentry and sheet metal work and usually the results secured by the bridge and building organization are good.

Because of the tropical growth the expense of grassing track and cutting right-of-way amount to much more per mile than the same class of work costs per year in the United States.

The problem of oil and water supply is the same as experienced elsewhere, the oil being delivered to the oil stations in tank cars and pumped to the tanks. In water supply various types of pumps were used, depending upon the source of supply. They are driven by steam and electric power. At one station water hydraulic rams are used with good results.

Floods in Mexico, Too.—The Southern Pacific Railway of Mexico suffered heavy damages to its roadway and structures recently due to heavy rains over a stretch of 47 miles between Querobodi and Pesquiera. The loss is estimated at $250,000.

Bridge and Building Association Meets in the South

Convention at Richmond, Va., on October 12-14 Well Attended and Characterized by Excellent Program

APPROXIMATELY 250 railway officers responsible for the construction and maintenance of bridges, buildings and water service facilities gathered at Richmond, Va., on October 12 to attend the thirty-sixth annual convention of the American Railway Bridge and Building Association. With the members of their families and of the Bridge and Building Supply Men's Association, the total attendance exceeded 400. The meeting was one of the most successful in the history of this organization, both in attendance and in the practical character of the program presented. All sessions were presided over by C. W. Wright, president of the organization and master carpenter of the Long Island railroad, Jamaica, N. Y.

C. W. Wright
President

More than 250 of those attending the convention left Chicago on Sunday afternoon and Cincinnati, Ohio, on Sunday evening preceding the convention on a special train provided by the Big Four and the Chesapeake & Ohio railways, arriving in Richmond Monday evening. Following the adjournment of the convention, practically all of those attending the convention visited Norfolk where they inspected the coal handling and other terminal facilities and other features of interest in that vicinity, traveling on a special train provided by the Chesapeake & Ohio.

The annual dinner of the Bridge and Building Association and of the Bridge and Building Supply Men's Association was held on Wednesday evening with an informal but thoroughly enjoyable program followed by dancing.

Immediately after calling the convention to order on Tuesday morning, the members were welcomed to Richmond by J. Fulmer Bright, mayor, and by Eppa Hunton, president of the Richmond, Fredericksburg and Potomac. C. W. Wright then reviewed the work of the association during the past year, referring particularly to the improvement in the financial condition of the organization and to the uniformly good work of the committees.

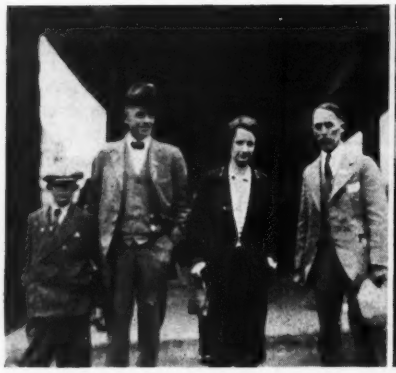
Reports were presented by committees on: Protecting Structures over Tracks from Locomotive Gases; The Use of Motor Cars by Bridge and Building Gangs; Pumping Equipment for Various Kinds of Service; Relative Merits of Different Kinds of Roofing Materials for Various Types of Railroad Buildings; Methods of Repairing Disintegrated or Poor Concrete; The Application of Protective Coatings to Structural Steel; The Use of Creosoted Timber, Including the Selection of Woods Best Adapted to Treatment; and The Use of Compressed Air on Bridge and Building Work.

Interspersed between these reports were addresses and papers by: L. B. Allen, superintendent of maintenance, Chesapeake & Ohio, on the Organization of a Maintenance of Way Painting Force; T. H. Carrow, chairman Safety Section, American Railway Association, on the Reduction of Accidents in the Bridge and Building Department; Earl Stimson, chief engineer of maintenance, Baltimore & Ohio, on the Framing of Bridge Timbers Before Treatment; and W. D. Faucette, chief engineer, Seaboard Air Line, on Some Comments upon Our Public Relations.

Abstracts of these papers and of the committee reports will be found on the following pages.

A further feature of interest was an address by Major E. D. T. Meyers, consulting engineer, Richmond, who described a number of highway and railway bridges of note in the vicinity of Richmond, emphasizing special features in their design which he thought would prove of interest to those present.

At the closing session on Thursday morning, the following officers were elected for the ensuing year: President, Elmer T. Howson, editor, *Railway Engineering and Maintenance*, Chicago; first vice-president, F. C. Baluss, engineer of bridges, Duluth, Missabe &



Secretary Lichty and Assistant Secretary Hein.

Perfecting the Plans for the Bus Ride Around Richmond.

The Ladies Were Very Much in Evidence at Richmond.

Northern, Duluth, Minn.; second vice-president, Maro Johnson, assistant engineer, Illinois Central, Chicago; third vice-president, J. S. Huntoon, assistant bridge engineer, Michigan Central, Detroit, Mich.; fourth vice-president, C. S. Heritage, bridge engineer, Kansas City Southern, Kansas City, Mo.; secretary-treasurer, C. A. Lichty (re-elected), purchasing department, Chicago & North Western, Chicago; assistant secretary, F. E. Weise, engineering department, Chicago, Milwaukee & St. Paul, Chicago; members executive committee: W. T. Krausch, engineer of buildings, Chicago, Burlington & Quincy, Chicago; R. C. Bardwell, superintendent water service, Chesapeake & Ohio, Richmond, Va., and H. I. Benjamin, assistant division engineer, Southern Pacific, Portland, Ore. Minneapolis, Minn., was selected as the location of the next convention.

The Committee on subjects, W. S. Lacher (*Railway Engineering and Maintenance*), chairman, suggested the following topics for consideration and report at the next convention.

(1) Methods of applying and repairing waterproofing on concrete structures and those features of design relating thereto.

(2) The more uniform distribution of bridge and building work throughout the year.

(3) Stock yards facilities and their maintenance.

(4) Methods of handling excavations for various types of foundation work.

(5) The maintenance and operation of water treating plants.

(6) The relative merits of various materials for floors on highway bridges.

(7) Recent developments in concrete construction practices. (a) The application of water cement ratio and its influences in the determination of concrete proportions. (b) The use, advantages and disadvantages of quick setting cements and accelerators.

(8) The protection of men doing work under traffic.

R. H. Aishton on Service

R. H. AISHTON, president of the American Railway Association, addressed the convention on Tuesday afternoon, stressing the part that members of organizations like this can take in the improvement of railway service and the stimulation of a favorable public opinion. He traced the part that the bridge and building department necessarily takes in the rendering of continuous service, stating that "the railways of the world have been closely linked up with the advancement of civilization and to a large extent the growth of transportation and the advancement of the principles of bridge design and contruction are a measure of the growth of civilization. Bridges are an important link in the great chain of railways and essential to safety and service." Mr. Aishton then traced the rapid increase in the loads that bridges have been called on to carry in recent years, summing up this development with the statement that "the load passing over the tracks of our railroads has increased 40 per cent in the last six years and it is bound to increase, which makes it evident that it is not your problem to keep up with this progress, but to keep ahead of it. The railroads are going ahead or the nation will die. Upon your endeavors and initiative will depend to a large extent the future of the railroads."

After referring to the record breaking car loadings in recent weeks, which have exceeded all estimates and which have been handled without a car shortage, Mr. Aishton said that "this has had a very important part in molding favorable public opinion toward the railroads, which is essential to increased railroad earnings. The part of the men in your work is to further this favorable public feeling by doing your work better and more economically."

In concluding his address, Mr. Aishton referred to some of the present day problems of the railroads, including the possibility of competition from waterways, motor buses and trucks, and airplanes, stating that this competition can be met by "adequate and efficient service performed in the most economical manner. Your organization can take an important part in the rendering of this service and if it is rendered properly, there will be no competition."

Organization of Painting

L. B. ALLEN, assistant to the vice-president, Chesapeake & Ohio, Richmond, Va., presented a paper in which he pointed to the need for a more systematic conduct of bridge and building painting and described the organization developed by the Chesapeake & Ohio about two years ago for the purpose of insuring a more uniform painting program. This Chesapeake & Ohio plan which provides for a limited number of gangs employed the year around and the centralized direction of the work under a general supervisor of painting, was described in an article appearing in *Railway Engineering and Maintenance* for June, 1926, page 237. Mr. Allen concluded his outline of this plan for the conduct of painting with a review of some of the results obtained, the following being excerpts from these concluding remarks showing the advantages obtained.

A 55-Year Service Man With the Erie, W. O. Eggleston and Wife.

The Bride and Groom from Cincinnati, Mr. and Mrs. J. T. McGarry.

Presidents Elect Nelson and Howson Plan the Next Convention.

"Under the former practice of doing the painting with small seasonal division forces during a year's program just previous to the reorganization, 12 or 14 gangs were employed with an expenditure for labor and material of about $180,000. This year, with a system organization, structures are being covered in practically the same territory at an estimated expenditure of $67,000 and accomplishing approximately the same amount of work. This is a reduction of more than 60 per cent.

"The system organization lends itself to the use of paint spraying machines to better advantage. There is undoubtedly great economy in the use of these machines. Some of the records made with these machines are as follows:

"Alderson, W. Va., freight house, 6,453 sq. ft., one coat, labor cost $22.79. Alderson passenger station, 6,184 sq. ft., labor cost $14.75.

"Ronceverte, W. Va., freight house, 10,191 sq. ft., labor cost $14.71.

"Y. M. C. A. building at Stevens, Ky., 13,077 sq. ft., labor cost $33.82. This represents less than ¼ cent per sq. ft. for application by the spray.

"Seven buildings at Clifton Forge, Va., containing 20,016 sq. ft., $275.62 for labor and material. The labor and material cost on these seven buildings was less than 0.7 cents per sq. ft. to apply two coats.

"We are getting an average of 375 sq. ft. per gal. on first coat work with spray.

"One other advantage of system organization was recently demonstrated in a sudden change of program. For good reasons it was decided in midseason to freshen up the main line buildings with a coat of paint. The system forces were engaged primarily on bridge work at the time, but within 15 days the entire program had been changed without disorder and all system forces were employed in painting buildings. Under the old arrangement, a month or six weeks would have elapsed in getting the forces organized and supplied with a different kind of paint and equipment.

"The favorable results in keeping down the labor turnover which we had anticipated have also been fully realized. After two years in which the system has been in effect, 80 per cent of the original employees are now on the forces. Under the old system the labor turnover was 75 to 80 per cent each year. Maintenance of way painting under a system organization and the employment of a permanent all-year painting force is practical, economical and desirable. This has been clearly demonstrated and all that was expected of it has materialized."

In response to questions, Mr. Allen stated that the programs of work originated with the division engineers who send them to the superintendent of maintenance, who in turn prepares the season's painting program. This includes all maintenance work and a reasonable allowance for improvement work, although it is not unusual for a sufficient amount of new work to be authorized to require an increase in the force.

T. H. Carrow Addresses Convention on Accidents

AT A SESSION on Tuesday evening, T. H. Carrow, supervisor of safety, Pennsylvania, and chairman of the Safety Section, American Railway Association, addressed the convention on the reduction of accidents to bridge and building employees, his address being similar to that presented before the recent convention of the Roadmasters' Association at Chicago and published in the October issue, page 397. In this address Mr. Carrow pointed out the high accident rate among bridge and building employees and urged the co-operation of supervisory officers of this department in reducing the hazards now incurred and in training their men in the adoption of safer practices. His address was received with enthusiasm and a resolution was adopted pledging the support of the Bridge and Building Association in the achievement of the goal of the Safety Section providing for a 35 per cent reduction in accidents in the five-year period ending with 1930.

In the discussion of this paper, F. C. Baluss (D. M. & N.) grouped the causes contributing to accidents among bridge and building employees in five major groups, including: (1) Falls of persons from bridges, ladders or roofs or their tripping over obstacles; (2) the collapse of platforms, scaffolds or structures —which should lead to more secure construction; (3) the handling of materials—which calls for the standardization of signals and the training of men to watch for these signals; (4) the use of hand tools—calling for the elimination of unguarded saws, etc.; (5) electric current, which results in relatively few injuries but in a high percentage of fatalities.

A. I. Gauthier (B. & M.) deprecated the common practice of hiring men without regard to their habits of work and other important characteristics and urged that more attention be given to the selection of men. H. I. Benjamin (S. P.) emphasized the necessity of supervisory officers being constantly alert to detect and correct unsafe practices by calling every such practice to the attention of the foreman at the time it occurs and before it gains headway.

C. W. Wright (L. I.) emphasized the necessity of instructing flagmen properly regarding their duties. Mr. Benjamin stated that the Southern Pacific is now compelling maintenance of way flagmen to carry with them written instructions showing the reason for their flagging and the trains to be flagged, which instructions are required to be shown enginemen. L. C. Prunty (U. P.) stated that it is the practice of the Union Pacific to require a flagman to stay out until the foreman himself calls him in by word of mouth, a foreman not being allowed to send another man to call him in.

Protecting Structures Over Tracks from Locomotive Gases

REPORT OF COMMITTEE

Locomotive gases affect overhead structures in two ways: (1) mechanically by the direct force of the blast and, (2) by chemical action of the gases on the different materials of the structure.

Locomotive gases contain a considerable amount of sulphur and this combines with the moisture in them to form sulphurous acid and sulphuric acid. These attack and destroy the steel by combining with it to form ferrous sulphate and ferric sulphate. The action of these compounds leaves a clean metal surface exposed to further attacks by chemical action and this deterioration is accelerated by the heat of the gases.

Protection by Painting

The information received by the committee indicates that few, if any, roads find paint an efficient protection for a headroom of less than 22 ft. except at a very great expense. The oil-burning roads claim to be fortunate exceptions to the last statement, two reporting that the exhaust gases from this fuel are not injurious to overhead structures.

A number of roads depend on paint for protection where the headroom is 22 ft. or over. The Illinois Central considers that this headroom puts the structure beyond the blast action. The extensive use of special graphite, bituminous, emulsified paints and other special proprietary coatings is reported by different roads with varying results. However, the general tone of the reports received favors frequent inspection and the application of red lead in oil and graphite or other good paints wherever structures are to be protected by painting. The careful cleaning of the steel, with the application of the red lead as a priming coat and the use of graphite or other good paints as covering coats seems to be the favored procedure.

In general, if painting is the only method of protection, it is effective only at the price of eternal vigilance. No definite statements can be made concerning the life of structures protected by paint as conditions are different for each structure.

Encasement in Concrete and the Treatment of Concrete Surfaces

The next method of protection is the encasement of steel members in concrete or the use of reinforced concrete. The information furnished by various roads about the use of concrete shows varying degrees of success. The minimum thickness of the concrete over steel varies from 2 in. to 4 in. In the older structures the steel reinforcement was placed too close to the lower side of the slab and often the concrete was porous. This has resulted in the necessity for the repair or replacement of many structures which were considered practically indestructible at the time of their erection.

It would seem from the information received by the committee that unprotected concrete is not considered sufficient protection over steel in a great many instances.

Another form of concrete protection for both steel and reinforced concrete structures is the use of gunite. This is the application of cement mortar placed with a cement gun operated by compressed air. Gunite, which was developed in 1909, was first used more for repair than for new work and was applied without any reinforcing mesh, after the surface of the old concrete had been thoroughly cleaned by sand blasting, chemicals, or other approved methods, but it was found that the material so applied soon spalled off. Since these first installations, many improvements have been made in its application.

E. T. Howson
First Vice-President

F. C. Baluss
Second Vice-President

It is difficult to determine the length of life of this protection although one road, the Hocking Valley, reported a gunite protected bridge in excellent condition after 13 years' service. Where clearances are low, the gunite is often protected, in turn, by blast plates. Costs for applying gunite vary from 40 to 60 cents per sq. ft.

Considerable attention has been given to the construction of the roofs of roundhouses and other structures, the undersides of which are subjected to gas action but most of this study has been directed towards the elimination of sweating. This is important because the condensed moisture helps to form the acids which attack the steel. In some of the newer structures, an effort has been made to protect the reinforcing steel from both moisture and gases by placing it deeper in the concrete and also by using a clay tile and tee-beam construction.

The life of roundhouses and other similar structures can be lengthened materially by designing them so that gases are carried away or diluted before they have a chance to attack the structure.

The use of blast plates on the underside of structures over tracks is not new. Wooden blast plates were used on the Santa Fe 30 years ago where 1½ to 2-in. matched and dressed oak wore out in less than a year at certain crossings; similar results were obtained from the use of matched and dressed yellow pine. A longer life was obtained from pine flooring protected by steel plates over the center of the track but these failed on account of the failure of the fastenings to hold in the charred wood. However, several roads report the use of wooden blast plates with satisfactory results.

The use of asbestos board blast plates is reported by several roads. One recent installation of this sort was made by the Chicago, Burlington & Quincy in protecting the steel of a driveway over the tracks on its Missouri River bridge at Kansas City, Mo. The headroom at this place is approximately 22 ft.

The Southern Pacific Lines in Louisiana and Texas report the use of a shield made of a shallow inverted trough of ½ in. magnesia board 4 ft. in width which was installed in 1924, and has given satisfactory service to date.

Another method of protection reported by the Michigan Central is the use of troughs of ¼-in. metal placed close under the members and filled with either

Maro Johnson
Third Vice-President

J. S. Huntoon
Fourth Vice-President

asphalt waterproofing cement or coal tar pitch. These are bolted on in such a manner as to be easily replaced and one of these, where the headroom was 18½ ft., gave a service of 14 years.

No doubt, at present, more cast iron and steel blast plates are being installed than any other type for the protection of both steel and concrete structures, and, on the whole, they seem to give fairly satisfactory results. Reports received seem to favor the use of cast iron plates for the lower clearances and steel plates for higher clearances although both kinds are used for various clearances. Copper-bearing steel is being tried by a number of roads but none can make a service report at this time. Cast iron blast plates applied by the Chicago, Milwaukee & St. Paul to a bridge built in 1913 reduced stringer renewals to one-half those required in another bridge without this protection.

The method of attachment to the structure is an important consideration in the use of any sort of plate and every effort should be made to design the attachment so that steel or wrought iron bolts shall not be exposed to exhaust action. Consideration of safety, the expense of renewal, and accessibility for inspection should govern the choice of both the design of the plate and the method of atachment.

Sheet steel, either flat or corrugated and protected by asphalt, asbestos and waterproofing coatings has been used in some cases for the sides and roofs of roundhouses, etc., and the Illinois Central is considering the use of asbestos-protected corrugated steel sheets and corrugated transite sheets for the sides of some of its cheaper roundhouses. The committee has no information as to the length of life of these materials.

Conclusions

None of the methods described gives an absolute and permanent protection against smoke and gases but certain conclusions can be drawn from the data collected.

1. Paint delays, but does not check, the deterioration of a structure except for high clearances. The expense of maintaining structures with paint where clearances are low is not justified by the results obtained.
2. The use of concrete for encasement of steel or reinforced concrete construction is usually satisfactory for clearances of 22 ft. or more without additional protection by blast plates. For clearances less than 22 ft., blast plates should be used to protect the concrete.
3. Gunite for new work and for repair work has proven satisfactory and is recommended for more general use.
4. Wooden blast plates are being used by a number of railroads but the maintenance costs are high by reason of the rapid deterioration of the fastenings.
5. Blast plates of transite, magnesia board, etc., are used to some extent but the committee is not informed as to their lasting qualities.
6. Cast iron and steel blast plates are used extensively and satisfactory results are reported. Cast iron plates are preferred to rolled steel plates by reason of cast iron being less subject to corrosion.
7. The attachment of any sort of blast plate to a structure should be so designed that the fastenings will not be exposed to the action of the blast. Care should be taken to provide a sufficient number of supports, especially for the metal plates and, if possible, the fastenings should be embedded in concrete.
8. Structures should be designed, whenever possible, so as to eliminate pockets on the under side and to permit the rapid diffusion of the gases. This applies to bridges and viaducts as well as to enginehouses and train sheds.

Committee: F. H. Masters, chairman (E. J. & E.); L. B. Alexander, vice-chairman (M. C.); P. B. Spencer (N. Y., N. H. & H.); A. E. Bechtelheimer (C. & N. W.); W. L. Smith (T. R. R. A. of St. L.); B. F. Stidfole (Penna.); F. E. Schall (L. V.); and F. A. Taylor (B. & O.).

Discussion

In discussing this report A. B. Scowden (B. & O.) and others emphasized the importance of so designing structures as to reduce to a minimum the opportunity for gas to collect. Mr. Scowden emphasized the desirability of the development of an asphaltic compound which would remain plastic and still not drip. He reported satisfactory experience with blast plates of cast iron although in some instances he had found that they had been so placed as to promote rather than retard corrosion. For this reason he favored their being placed in such a manner as to permit of inspection. In discussing this phase of the subject, C. S. Heritage (K. C. S.) stated that the application of blast plates presents new problems for every structure since these plates must be so attached as to meet the local conditions existing at that particular point. F. H. Masters (E. J. & E.) described a recent installation of sheet lead around the bottoms of girders which had stood up satisfactorily to date.

W. T. Krausch (C. B. & Q.) stated that as a result of an inspection of a number of old roundhouses on that road on which the roofs are supported by trusses of timber and wrought iron, most of which were

The Convention Crowd at Richmond.

found to be in excellent condition, he was convinced that wrought iron requires little protection from locomotive gases. In the construction of roundhouses, this road has not used concrete for roofs because of the danger of its sweating, but builds them with vertical walls of brick or other non-combustible materials and with roofs of mill construction, preferably treated.

P. N. Nelson (S. P.) stated that contrary to the inference in the report much difficulty is encountered with corrosion on lines with oil burning locomotives. On the Southern Pacific it has been the practice to keep structures exposed to gases well painted, but this has not been sufficient. The roofs of roundhouses are commonly supported with wooden roof trusses in which the bolts have been found to corrode.

The Use of Motor Cars by Bridge and Building Gangs

REPORT OF COMMITTEE

[*A large part of the report of this committee was devoted to a discussion of the mechanical details of motor cars. The abstract given below is restricted to such portions of the report as relate to their use rather than their design and construction.—Editor*]

WITH THE increased traffic on the railroads, together with the high cost of work train service, it has developed upon the maintenance of way officers to plan and arrange their work so as to make use of motor cars for transporting material and eliminate work trains whenever possible. Since the development of motor cars to a high degree and their use in connection with trailers, it is now possible to utilize them for transporting materials and equipment that formerly required the service of a work train, with resultant savings in dollars and cents. In many cases the motor car has become a necessity for transporting gangs to their homes for week ends due to the curtailment of passenger train service. In an emergency, such as a washout or burnout, a motor car is indispensable.

Motor Cars Classified

Motor cars have been divided into three classes, as follows: Class A, light inspection cars weighing not over 550 lb.; Class B, regular gang cars weighing not more than 1,000 lb. and Class C, heavy duty cars weighing over 1,000 lb.

Class B cars are standard for the average gang. They are made both direct-connected and with a free running engine. They are general utility cars having a seating capacity up to eight men and are capable of pulling one or more loaded trailers. These cars can be handled by two men when necessary. During the past year a two-speed transmission has been designed for this class of car to permit hauling heavier loads at low speed but this obviously adds weight to the car and when this feature is added it merges into a Class C car.

The Class C car is a standard gang car on many railroads. It is a heavy duty car with a seating capacity up to 10 men and is capable of pulling several loaded trailers. Most of these cars are made with a free-running engine. They are practical cars for bridge gangs by reason of their capacity for handling large gangs of men and hauling materials on trailers.

There is keen competition in the motor car field and at the present time there are about a half score of different makes from which to choose. Each car has its merits and the problem is to get the car most suitable for the gang. Present railroad efficiency requires standardization and this applies forcibly to motor cars. It would, however, be false economy to purchase a certain car because it has been adopted as standard when the economical handling of the work

Railroads From All Parts of the Country Were Represented.

of the gang demands a different car. Therefore, considerable thought and study should be given to the selection of a motor car that it will serve its economical purpose for the gang and at the same time meet the policy of the railroad with respect to standardization.

The main points to consider when choosing a motor car are first cost, adaptability, weight, pulling power or capacity, sturdiness, endurance, accessibility of parts for adjustment and repairs, economical fuel consumption and economical maintenance.

Uses of the Motor Car

The motor car as made at present is designed principally to propel itself on the track and to pull loads coupled on behind. In many cases the engine is made use of as a stationary power plant for operating circular saws, grindstones, drill presses, etc., and for operating air compressors to furnish air for pneumatic tools. This may be practical and economical for short jobs and in emergencies, but taking into consideration the time consumed to connect and disconnect the engine and the wear and tear of the motor car due to vibration of the engine, it is not practical or economical to use it as a permanent power plant. When a gang is equipped with pneumatic or electric tools a separate power unit should be provided for operating the air compressor or generator, as the case may be, and to operate other power driven tools.

Trailers

The push car was the first vehicle used by the railroads for transporting men and materials on the track. It has been with us ever since and it is now an important adjunct to the motor car. It is now in reality a trailer and a trailer may be either a car with a flat deck for carrying material or with a seat deck for carrying men.

There has been a tendency in the past to neglect the trailer and not give it the attention it deserves. The trailer should be sturdily constructed to withstand the abuse it may receive and should be provided with roller bearings. In fact, a trailer deserves the same care in design and development as a motor car. A properly constructed trailer, adequately maintained will go a long ways to reduce the operating cost of the motor car. Care should be used not to overload a trailer beyond the capacity specified by the manufacturers. For economical maintenance the trailers should have axles, bearings and wheels of the same size as the motor car with which they are used. Trailers for carrying men should be provided with brakes.

Speed

The safe speed at which motor cars may be operated is governed by several factors, among which are the kind and condition of the car, the load carried, the density of traffic, the location, and the weather. The chief objection to the use of motor cars in the past has been the accidents caused by high speed and careless operation, resulting in derailments and collisions. The following is considered the maximum rate of speed at which cars should be operated:

Do not exceed 25 miles per hour under any circumstances.

Do not exceed 15 miles per hour with a heavy loaded car, when pulling a trailer, and when operating on curves.

Do not exceed 10 miles per hour when operating in stormy weather; when passing trains standing on adjoining tracks; when passing workmen on the track; when passing through station grounds and through cities and towns.

Do not exceed 5 miles per hour when passing over frogs, switches, interlocking plants and railroad crossings; where the view is obscured and when passing over highway or street crossings protected by crossing watchmen or crossing gates. Push the car where the view is not clear ahead.

Stop—when passing a moving train on an adjoining track and when passing over highway or street crossing not protected by watchman or gates.

These rules apply when there is full knowledge of the movement of trains. When train movements are not known the car must be under full control and the speed governed by the alinement of track and the obstruction of vision so as to be able to stop and take the car off when a train approaches.

With the density of present day automobile traffic there is only one safe rule for crossing highways and

street crossings and that is to stop and flag across.

Committee: V. E. Engman (C. M. & St. P.), chairman; H. H. Eggleston (C. G. W.), vice-chairman; G. W. Koontz (St. L.-S. F.); W. F. Martens (A. T. & S. F.); T. B. Turnbull (A. A.); T. N. Heron (A. & V.), and G. L. Sitton (Sou.).

Discussion

It was evident from the discussion of this report that free running engines were considered essential for motor cars for bridge and building gang service, H. I. Benjamin (S. P.) pointing out that cars so equipped will start easier and without pushing and that they are essential where trailers are used.

The most active discussion in this report centered around the relative merits of the side and center load inspection cars. R. C. Henderson (B. & O.) and J. P. Wood (P. M.) opposed the use of side load cars under any conditions because of their liability to derailment. H. I. Benjamin (S. P.) stated on the other hand, that he was not yet prepared to abandon the side load cars as he had found that a number of his supervisors favored them because of the fact that they can be taken off the track more quickly in emergencies. W. T. Krausch (C. B. & Q.) stated that after an extended investigation his road had standardized on a center load car, although some of their supervisory officers still favored the older type. He stated further that when buying cars inspectors accompany them to train the new operators, who are then required to make reports of performance for 30 days. At the end of this period if these reports indicate that the operators are able to run the car they receive no further attention.

In response to a question, A. I. Gauthier (B. & M.) and C. R. Knowles (I. C.) expressed the belief that the operation of a motor car need not be affected by cold weather if reasonable precautions are taken, Mr. Knowles stating that cars are operated on his road in territories as far north as Sioux Falls, S. D., and as far south as New Orleans, La., without appreciable difference in performance.

Methods of Repairing Disintegrated or Poor Concrete

REPORT OF COMMITTEE

THE development of practicable methods for repairing concrete structures which display indications of deterioration or failure is a matter of importance to users of concrete. With the universal adoption of concrete as a material of construction, the capital investment in concrete is steadily augmented year by year, and the economic importance of rational procedure in the maintenance and repair of such units increases in magnitude and interest.

Deterioration in concrete, with respect to its general causes and extent, and advisable remedial procedure, may be broadly classified as follows:

1.—A concrete unit may be of poor quality throughout, due to inferior materials or improper methods of construction. In such cases the only practicable means of remedying the situation is complete reconstruction.

2.—A concrete unit may undergo some degree of surface disintegration, occasioned by the penetration of substances from the exterior. The rear surfaces of bridge abutments and retaining walls afford frequent instances of this character. In such cases it is usually possible to eliminate the difficulty by installing suitable drains and protecting the affected surfaces with proper waterproofing.

3.—A concrete unit may be subject solely to surface disintegration, due to causes similar to those mentioned under the preceding caption, air, water, etc. In this event, it is usually possible to effect a remedy by removing the defective concrete, placing dowels and reinforcement, and applying new concrete. In cases of this character, the use of air-placed concrete or mortar merits consideration.

4.—In some cases, where exterior disintegration is detected or apprehended, effective remedial measures may consist in the use of surface coatings, which may act—(a) mechanically, to seal the pores and voids, or (b) chemically, to make the surface water-repellent, or to neutralize the action of destructive agencies in the water or air.

Complete Reconstruction

Cases where complete reconstruction is unavoidable are relatively few and before such a step is definitely recommended or undertaken, the extent and cause of the trouble should be investigated thoroughly.

In some cases, bridge piers or abutments subjected to the influence of heavy traffic display indications of low compressive strength and a disposition to break. Where a condition of this kind is found, the direction and extent of the fissures and the general condition of the unit should be ascertained. If the cleavage penetrates through the interior mass, and the cohesion of the unit is impaired to a degree which renders it definitely unstable, its removal and reconstruction may be necessary. On the other hand, some defective units which, on a superficial examination, present the appearance of being vitally affected, may be so repaired as to extend indefinitely the useful life by the installation of new bridge seats, reinforced with grillages or other suitable media to effect a more symmetrical distribution of the load and a more uniform transmission through the supporting structure, to the foundations.

Where problems of this nature are presented, the character of the foundation claims a prominent place in determining the procedure. Even where the foundation is found unsatisfactory, it is sometimes possible to remedy the deficiencies of nature by the application of engineering skill in the form of sheet piling, grout, etc.

Surface Defects

Concrete surfaces sometimes develop blemishes due to the penetration of water, either pure and exerting a solvent and erosive action, or bearing in solution chemical reagents which act upon the concrete along the lines peculiar to their several characters.

Where a situation of this nature has developed, and where the deterioration is limited to the immediate surface, a remedy may sometimes be found in the application of suitable waterproofing protection.

Such coatings cannot be regarded as substitutes for concrete which has broken or eroded from the member affected, and if disintegration has progressed appreciably beneath the surface of the concrete, repair measures of a different character are required. Futher, the waterproofing itself demands protection.

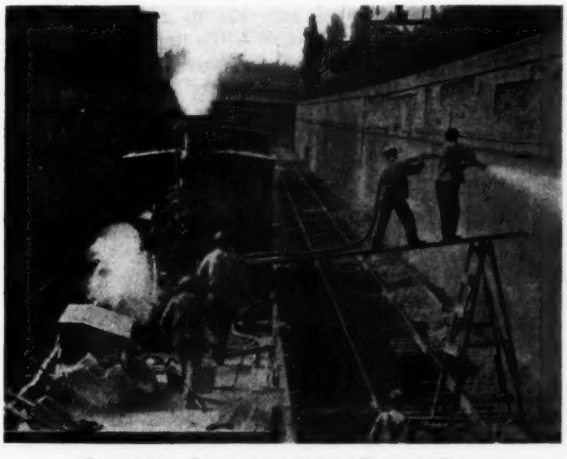
Methods of repairing surface disintegration which has not penetrated sufficiently to impair the stability or permanence of the unit as a whole consist substantially in the removal of the defective concrete and the placement of new concrete which will so homogenize with the body of the unit as to restore the strength contemplated in the design. The dominant problem involved is to secure proper cohesion between the old concrete and the new.

The question of securing a proper bond between concrete which has attained its final set and green concrete deposited thereon has engaged engineering thought for many years. Important factors are the presence of foreign matter on the surface to be covered, and the porous character of the mature concrete, which withdraws from the new mixture a portion of the water necessary for proper hydration.

To overcome these factors, it is vitally essential that the contact surface of the old concrete to which the new material is to be applied be scrupulously clean, and also that it be saturated with water as a preliminary to the placement of the repair concrete. A further object in the application of water is to expand the old concrete to a degree which will co-ordinate it with the green mixture.

The initial step in the prosecution of repairs is the removal of the defective concrete, and the exposure of a clean surface of sound material. In addition to the purely mechanical cleaning process, the use of an acid wash is sometimes resorted to when the final surface is reached.

The work of removal should be carried to a sufficient depth to insure the detachment of all particles of disintegrated or impaired concrete, and provide a surface of clean, sound material. Reinforcement embedded in the original unit and projecting into the affected section affords a ready and convenient source of supplementary bonding strength, which should be utilized to the utmost. The sections of such metal from which the old concrete is removed should be carefully cleaned by hand or with sand blast. Where the original unit contains no metallic reinforcement, or where such reinforcement is deficient, steel dowels anchored in the old concrete may be resorted to as a means of increasing the firmness of the bond. Where the section of repair concrete is very light, nails or staples may be substituted for the dowels, wire mesh or other reinforcement of a similar nature stretched across the exposed area, and attached to the original reinforcement, dowels or other individual metallic parts. The exposed concrete surface, to which the repair work is to be applied, should then be thoroughly flooded with water, and kept in intimate contact with moisture for several hours, to insure a condition of complete saturation.



Preparing Concrete With a Cement Gun.

While the establishment of any definite formula for the proportionment of repair concrete is difficult, it is desirable that this be a fairly rich mixture, at least that undue porosity be avoided. As trouble has sometimes arisen due to cleavage resulting from the contact of two masses of concrete of differently-proportioned mixes, the relative quantities of ingredients in the old concrete should be considered, and the new concrete should not be permitted to depart so widely from that ratio as to create the possibility of future difficulty from the source mentioned.

A factor vital to the success of concrete repair work is that of securing intimate contact and firm cohesion between the old and new material.

Use the Same Mix if Possible

Where mortar is used as a material of repair, the proportions of cement and sand should correspond very closely with those used in the original structure; that is, if the old concrete was a 1-2-4 mixture, the repair mortar should be in a 1-2 ratio. The mortar should be mixed, and allowed to stand for a period of two to four hours, depending upon the temperature conditions to which it is exposed, and, at the expiration of that interval, it should be re-worked without further addition of mixing water. It is believed that the same reworking of concrete as here mentioned for mortar will have a beneficial effect where concrete instead of mortar is used for repairs.

Where it is necessary to perform repair work on concrete structures during cold weather, precautions should be taken to prevent the freezing of the green concrete. This may be accomplished by the use of tarpaulins and steam pipes, salamanders or other media for producing and localizing artifically-generated heat. Under conditions of this nature, the use of quick-setting cement may be justified as a means of reducing the period during which danger may be apprehended from this source.

However, from comparatively recent tests and experiments, it would seem that high early strengths, averaging as much as 2,500 lb. per sq. in. in 3 days, can be secured from standard portland cement, if proper attention is paid to the rigid limitation of the mixing water and the use of rich mixtures, together with thorough mixing and the maintenance of favorable temperatures. If these conditions are observed, it is possible to increase the strength further by the use of calcium chloride admixture, although it is to be borne in mind that it is possible to obtain high early strength without the admixtures, as, in some cases, the use of admixtures is undesirable.

Committee: P. G. Lang, Jr. (B. & O.), chairman; R. C. Young (L. S. & I.), vice-chairman; P. N. Nelson (S. P.); Leland Clapper (D. & I. R.); G. W. Welker (Sou.); E. L. Sinclair (C. M. & St. P.), and Frank Ringer (M.-K.-T.).

Discussion

The discussion of this report was confined largely to descriptions of various members of specific failures of concrete structures on their roads and the manner in which they were repaired. P. N. Nelson, (S. P.) cited an instance where salt had appeared on about 50 ft. of the lining of a long tunnel with no apparent cause. He also told of several other instances of the same character and asked how to prevent this, stating that they had endeavored to paint the concrete without success. He also stated that the gases from oil locomotives cause considerable trouble on his road, for they united with the moisture on the concrete, to form a strong acid condition which leads to rapid disintegration. Chairman Lang, expressed the opinion that this might be a problem for chemists to solve through the preparation of a compound to mix with the concrete in order to overcome this condition. Wm. Shively, (C. R. R. of N. J.) told of the repair of disintegrated piers on the Newark Bay bridge where concrete jackets were built

Dan Higgins.

The Long Island Was Well Represented.

John Nelson Explains.

about them. A. I. Gauthier, (B. & M.) told of a similar experience in which an 8-in. reinforced concrete jacket had given good results.

In answering a question raised by J. D. Voorheis, (Wabash) as to the advisability of the feather-edge joint in making patch repairs, it was clearly indicated that those present preferred the dove-tail or square-edge joint.

W. T. Krausch, (C. B. & Q.) reported difficulty on sections of his road where only highly alkali water was available which gave them a poor concrete, citing several instances where failure had been directly attributed to this cause. He also mentioned the failure of certain concrete floors which are giving his road considerable trouble. Mr. Krausch stressed the necessity for a specific study of each piece of repair work and the desirability of making repairs in the light of this analysis and in accordance with approved practices. Specifically, he pointed out that to a large extent it was necessary for the new patch material to be as nearly as possible of the same consistency to the concrete in the structure to be repaired. He also emphasized the desirability of wetting the old structure freely before the patch material is applied.

The Framing of Bridge Timbers Before Treatment

By EARL STIMSON
Chief Engineer Maintenance, Baltimore & Ohio

IT IS universally conceded that all timber used for structural purposes that is exposed to conditions that produce decay, should be given preservative treatment. This includes all timbers used in bridge and trestle construction and some used in building and platform work. An adequate treatment costs considerable. To realize the maximum returns, great care must be used in protecting the timber, both before and after treatment.

Before treatment the timber should be carefully piled in a well drained storage yard, in such a way that the area of contact between the pieces will be the minimum and that there will be sufficient air space between them to permit free circulation of air. All this is to insure thorough air seasoning.

After treatment nothing should be done to the timbers that will penetrate the heavily treated outer zone and expose the lighter treated interior. To prevent this it has become a well established practice to adze and bore cross ties before treatment, and with better reason all bridge ties and timbers should be framed, sized or cut to lengths, as the case may be, before treatment. In other words they should be pre-framed. This is a very good practice from the timber preservation standpoint, as the timber goes into the structure perfectly protected by a heavily treated surface and not left exposed to infection and decay where framed or cut.

This pre-framing has a very strong appeal from an economic standpoint. There is probably no more awkward and expensive operation than the framing of bridge ties and timbers in the field. It is generally done at the bridge site by the crudest methods of handling and all with hand tools with a considerable waste in cutting. Much of the work is also necessarily done in unfavorable weather.

There has been ample excuse for this in the past, such as there was for pumping a hand car before the motor car was available. The trend of the times is to make the machine do it. This generally resolves itself into a centralization of effort and mass production, which is the essence of economy.

Framing Can Be Done Best at a Central Plant

The treating of the timbers requires that a large stock be concentrated at the plant for seasoning. Obviously, then, the timbers should be framed at the plant. This gives the opportunity to centralize the framing of all timbers required for a railroad or, if a large one, a designated part of it, and justifies the building of a sawing and framing mill. Such a mill should be equipped to cut to length and gain bridge ties, cut to length, posts, caps and sills, plane to thickness caps, stringers, ties, etc. and to cut bevel ties from blanks. This requires the following machines:

Cut-off saw—40 in., 20-hp. motor drive.
Table ripping saw—36 in., 30-hp. motor drive.
Gainer—12-in. head—40-hp. motor drive.
Planer with four heads to take timber of a maximum size of 12 in. by 20 in., 75-hp. motor drive.
Electrically operated drilling machines for boring.
Pneumatic shaving and saw-dust collection system.
Carriage saw-mill—48-in., friction feed, 30-hp. motor drive.

Such a mill, housed in a light steel frame corrugated steel covered building, will cost about $35,000.

The writer built such a mill at the treating plant owned and operated by the railroad with which he is

Doug Waugh Leads the Way to Lunch.

The Ladies Enjoyed the Trip.

Where the Chesapeake & Ohio Begins.

connected. All machines are motor driven. The current is furnished from the power plant of the treating plant. As several of the machines were released by the motor power department and were taken over at a depreciated price, the actual cost of the mill was $30,790.

This mill was started in full operation in January, 1925. The output for the year was:

Framing Bridge Ties and Guard Rails:	Pcs.	F.B.M.
Ties of uniform section	18,030	1,442,400
Bevel ties	4,059	389,664
Ties with elevation blocks	1,078	120,736
Guard rail	7,377	472,128
Trestle ties—planed	11,007	528,336
Total	41,551	2,953,264

The cost of framing the bridge ties and guard rail, including all charges, both operation and fixed, was $6.96 per thousand feet B. M., as compared with $16 per thousand if done by hand. The cost of sizing the trestle ties, cutting to length and planing to thickness, was $4.77, as compared with $7 additional cost if bought sized to thickness. The saw mill was not installed until 1926, so the plant involved in the 1925 operations cost $28,940. On the basis of these unit costs the savings for the first year were $23,085 or 80 per cent of the cost of the plant. The value of the increased life of the treated timber that accrues from the pre-framing, can at best only be estimated, but the savings in comparison with hand methods in the field are subject to exact determination, as in the instance just cited.

Framing Can Be Done in Advance

When it was proposed to frame all bridge ties and timbers at a central plant, dire results were prophesied. It could not be done. However, this did not prove to be the case. Much of the framing is of timbers of standard dimensions, and requires no special information or plan for framing. This refers particularly to such items as trestle ties which are cut standard length and sized to uniform thickness and not dapped, the sizing of stringers and caps, the framing of guard rails and standard bridge ties with daps of uniform depth.

For other than standard sizes it is necessary to furnish the mill with framing plans giving the dimensions in detail. This becomes somewhat complicated on the longer deck girder spans, with the varying number of cover plates, and when on a curve it becomes still more interesting. The framing plans for renewing existing decks are made up on the divisions from measurements taken in the field. For new bridges and for the more complicated renewals special framing plans are made up by the bridge engineer. When there are ties of several different framings on a bridge, the ties are numbered on the plan, which numbers are stamped on the ends of the corresponding ties for identification in placing on the bridge. It is remarkable how few misfits are found and these are more often found to be results of mistakes in the framing plans than mistakes made in the mill.

More Power Equipment Should Be Used

Maintenance of way men have been, with some just cause, open to the charge of being over conservative in adopting mechanical appliances to maintenance work. This may not have been entirely their fault, as the managements have in the past likewise been slow in authorizing expenditures for mechanical appliances and labor saving equipment for this purpose.

It costs money to save money in the sense of effecting economies and reducing costs. Until quite recent years little thought was given to the use of power machines for track work or even bridge or building work beyond, perhaps, the hoisting engine and the concrete mixer. The perfection of the gas engine and the greater availability of electric power have solved the power problem and have made possible the adapting to maintenance work of a variety of machines, in conveniently portable form, for performing practically all operations. First came the motor car, saving large sums in travel time, then the pneumatic tie tamper whose power plant is also available for use with numerous small tools such as riveters, drills, wrenches, cutting tools of various kinds, paint sprayers, etc. A similar power plant, of readily portable size, furnishing compressed air for the operation of many of the tools used in bridge and building work, proves a great time and money saver. Of the larger equipment the locomotive crane presents great possibilities for economies in handling bridge and the heavier building work. The crane is an especially good investment as it can be used for so many purposes on a railroad that it is seldom idle. To get a full return on the investment the machines must be kept busy.

Must Reduce Costs

The present day labor problems and the higher costs of both labor and materials make it imperative that advantage be taken of every means of reducing costs, whether it be the use of mechanical appliances to conserve man power, improved methods of handling work or economies in design of structures. I appeal for the more general use of mechanical appliances and improved methods and practices to bring about higher efficiency and reduced costs in the maintenance of way and structures, and to make our contribution to the efficient and economic operation of the American railroads

commensurate with the contributions made in conducting transportation and in the maintenance of equipment.

Discussion

In reply to a question Mr. Stimson said that it is the practice of the Baltimore & Ohio to cut grooves in bridge ties for rivets although in one case where the rivets were so staggered that so much of the timber would be cut away that the strength of the stick would be decreased no grooves were cut, with the result that it was found that the ties seated themselves over the rivets when the first train passed. As a result he does not now believe that it is necessary to groove ties for rivets. W. Shively (C. R. R. of N. J.) stated that none of the 26,000 ties placed on the bridge recently completed across Newark Bay were grooved for rivets, but that they were permitted to seat themselves. E. E. Candee (N. Y., N. H. & H.) stated that it is now the practice of his road to frame all bridge timbers according to plans and then to brand them for identification prior to treatment. Relatively little difficulty has been encountered in the field with incorrect framing.

Pumping Equipment For Various Kinds of Service

REPORT OF COMMITTEE

WATER supply pumping equipment may be divided into types for (1) surface supplies and (2) deep well supplies. As a general rule surface water supplies are preferable to deep well supplies. Pumps for surface supplies may be generally classed, with respect to the application of energy from the prime mover to the water, as (1) reciprocating (piston or plunger) pumps and (2) centrifugal pumps. The common types of reciprocating pumps are the single-cylinder double-acting, duplex double-acting and triplex single-acting.

The design of centrifugal type pumps has now been standardized to a large extent, the common types being the (1) turbine and (2) the volute. The turbine pumps, with diffusion vanes, are designed and adapted for heads of 150 ft. and over. The volute pumps, without diffusion vanes but with spiral casing designed to change velocity head to pressure head, are used for heads under 150 ft. The volute pumps may be further classed as single or double suction, open or closed impeller.

Comparison of Pumps for Surface Supplies

Reciprocating	Centrifugal
High first cost.	Low first cost.
Excellent durability.	Good durability.
Good efficiency.	Fair efficiency.
Maintains good efficiency for varying conditions of head and delivery.	Is not efficient for constant variations in head or delivery.
Will handle high suction lifts.	Not satisfactory for high suction lifts.
Easy to prime when necessary.	Must always be primed.
Low maintenance costs.	Very low maintenance costs.
Heavy weight requires substantial foundation.	Light weight and less substantial foundation.
Large floor space.	Small floor space.
Noisy in operation.	Little noise in operation.
Discharge is pulsating.	Discharge is non-pulsating.
Liability of damage to pump or pipe lines by closing of valve on discharge lines.	Not injured by sudden closing of valve on discharge line.
Not successful for handling sandy water.	Little injury from handling sand and gritty matter.
Speed of operation is low, requiring reducing gears for motor drive.	Speed of operation is high and very well adapted to direct motor drive.
High starting torque.	Low starting torque.

Deep Well Supply Equipment

Pumps for deep well supplies may be generally classed as (1) deep well reciprocating pumps, (2) deep well centrifugal or turbine pumps, and (3) air lifts. The diameter of the well casing is the controlling factor in capacity since it limits the size of the equipment that can be installed.

The most common types of deep well reciprocating pumps are the (1) single-plunger, single-acting, (2) single-plunger, double-acting, and (3) double-plunger, single-acting. The deep well centrifugal or turbine pump is a vertical multi-stage pump with an extended shaft, especially designed for use in wells. It is designed primarily for large capacities and for settings of not over 150 to 200 ft.

Comparison of Deep Well Type Pumps

Reciprocating	
Medium first cost.	Suitable for high head above ground.
Low capacity.	Fair efficiency.
Usually limited to 300-400 ft. setting.	Medium maintenance.
Suitable for high head above ground.	Fairly satisfactory for sandy water.
Good efficiency.	Perfect alinement is necesary.
High maintenance.	**Air Lift**
Not suitable for sandy water.	Low first cost.
Well hole must be fairly plumb.	Very high capacity.
Turbine	Limited only in setting by limitation of compressor.
High first cost.	Intermittent flow.
High capacity.	Requires booster for high head above ground.
Usually limited to 150-200 ft. setting.	Low efficiency.
Even flow.	Low maintenance.
	Unaffected by sand in water.
	Can be used in crooked holes.

Type of Power

Steam, oil engine, or electric power may be used for any of the types of pumping equipment for surface supplies or deep well supplies. On account of its greater economy of operation oil engine equipment is largely displacing steam equipment. Where electric power is available at reasonable cost, motor drive will usually prove economical on account of the elimination of operating attendance possible through the installation of automatic control.

Comparison of Types of Power

Steam	
High first cost.	Heat not available.
High operating attendance cost.	Noise sometimes objectionable.
Self-contained unit.	Medium space and heavy foundations required.
High maintenance costs.	Efficiency high and fuel cost low.
Slow in starting.	**Electric**
Heat, available for other purposes.	Low first cost.
Dirty and smoke objectionable.	Suitable for automatic control, no attendance.
Large space and heavy foundations required.	Dependent on outside sources.
Efficiency low, making fuel costs high.	Low maintenance costs.
Oil Engine	Quick starting.
Medium first cost.	Heat not available.
Medium operating attendance cost.	Clean and noiseless in operation.
Self-contained unit.	Small space and light foundations.
Medium maintenance costs.	Efficiency high but power rates usually high.
Quick starting.	

On account of the greater viscosity of oil as compared with water, its resistance to flow presents special features in equipment for pumping. To reduce the viscosity and permit easier handling, steam heating coils are commonly provided in tank cars, sump tanks, and storage tanks and pipe lines are generally equipped with either an inside or outside steam heat line.

The reciprocating type, direct-acting, duplex plunger pump is most commonly used for fuel oil pumping. The design must be exceptionally rugged and proportions such that with a given steam pressure a pumping pressure of up to 800 lb. per sq. in. may be reached if necessary in starting a flow of cold heavy oil in the pipe lines. The pump valves should be large in area and all passage ways ample in order to reduce the friction through the pump. The pump should be set with a maximum suction lift of not over 12 ft. and less if possible. On account of the varying conditions of the head, centrifugal pumps are not well adapted for efficient operation of railroad fuel oil pumping stations.

Fire Protection Service

Where high pressure water from a fire line system is used for other general purposes around a terminal, direct-acting duplex steam pumps will be found more satisfactory as their efficiency remains high under varying delivery conditions. For systems requiring water only during the time of a fire centrifugal pumps are suitable on account of their quick starting and uniform delivery. Fire service pumps should be installed in duplicate to insure utmost reliability and if motor drive is used, it is sometimes advisable to provide other power for the duplicate unit.

Boiler Washing Service

For pumping equipment necessary for the rehandling of water for washout and fill-up purposes in engine houses, the pressures usually desired are from 100 to 110 lb. on lines and the temperatures of the water will vary from 100 to 200 deg. F. Since the amount of water required will vary according to the number of engines being handled simultaneously, reciprocating direct-acting duplex steam pumps are most commonly used because of their higher efficiency. They must be fitted with valves suitable for hot water. Direct connected motor-driven centrifugal pumps have been used but not as satisfactorily on account of packing trouble due to fluctuations in the temperature of the water handled.

Committee: H. H. Richardson (M. P.), chairman; R. C. Bardwell (C. & O.), vice-chairman; J. H. Grover (A. T. & S. F.), John Sheldon (Erie), L. C. Prunty (U. P.), C. J. J. McCarthy (C. M. & St. P.), John W. Porter (C. N. R.), H. A. Stoner (D. & H.), and J. B. Duncan, Jr., (S. P.).

Discussion

The air lift pump received special consideration in the discussion of this report, a number of members questioning whether their use was warranted on account of their high cost of operation. O. C. Anderson (S. P.) stated that on his road they are rapidly giving way to deep well centrifugal pumps. R. C. Bardwell (C. & O.) pointed out that under certain conditions air lift pumps render a service not possible otherwise. As an illustration he cited one plant on his line where a larger quantity of water is required from a small well than could be secured with an ordinary deep well pump. C. R. Knowles (I. C.) pointed out that air lift equipment may sometimes be justified at points where excess air compressor capacity is available. W. T. Krausch (C. B. & Q.) stated that the Burlington operates five deep wells with air lifts, three of which are over 1,000 ft. deep and that while expensive to operate they are more practical than other equipment.

S. J. Johnson (M. & St. L.) stated that he has installed approximately ten automatically-controlled electrically-operated pumping units during the last two years, as a result of which he has found it possible not only to reduce the cost of operation greatly, but also to curtail the amount of storage capacity required.

Relative Merits of Different Kinds of Roofing

REPORT OF COMMITTEE

THE QUALITIES to be looked for in a roofing material are: (a) dependability, it must be leakproof for the length of time the roof is designed to last; (b) durability, the probable period of time the roof will last without renewal or heavy repairs; (c) economy, the cost, in money, of construction and probable repairs for the assumed life of the roof; (d) appearance, except in flat roofs hidden by parapet walls; (e) adaptability. Some roofing materials may be used on any roof, from a flat roof to one of the steepest pitch, while other materials are good only on flat, or nearly flat surfaces and still others are fit only for use on surfaces of steep pitch.

Asbestos-Cement Shingles—Asbestos shingles possess probably, in the highest measure, the characteristics of dependability, durability, economy and appearance. They are manufactured in a wide range of shapes and colors. Roofs of this material should have a pitch of six inches or more to the foot. Although they are frequently placed on roofs having inclines of less than 6 in. per ft., this practice is not recommended.

American method 8 in. by 16 in. shingles laid 7 in. to the weather and fastened with copper nails, make a dependable, durable and comparatively inexpensive roof that is given an A rating by the National Board of Fire Underwriters.

Natural Slate Shingles—Natural slate shingles are applied in the same manner as asbestos-cement shingles and perhaps where the best quality of slate can be obtained may give as good service.

Tin and Sheet Metal—Roofs of tin, if proper precautions are taken in laying and if the quality of material is the best, give long and good service. The same is true in a less degree of galvanized steel sheets. They have the advantage of adaptability to any pitch of roof but must be kept painted.

Slate Surfaced Asphalt Shingles—For the cheaper grade of stations or on branch lines or other locations where the ornamental feature is less important, slate-surfaced asphalt shingles of the best grade obtainable are recommended. Many felt shingle roofs have been in service between 15 and 20 years and are still good. Asphalt shingle roofs are rated by the National Board of Fire Underwriters as "Class A" if made of asbestos felt and "Class C" if made of rag felt.

Wood Shingles—Because of the fire hazard, this

committee cannot recommend wood shingles on any type of railroad buildings; but such material is still used and its use will probably be continued in Canada and the Pacific coast teritory for frame buildings such as passenger stations, freight stations and other minor buildings. The advantage of a wood shingle roof is that it is not heavy and a simple light truss may be used.

A recent case has been found in Oregon, where rainfall is probably greater than in many other states, where a building having shaved cedar shingles 60 years old was dismantled. These shingles were found to be in good condition although worn extremely thin due to erosion by rain.

Roll Roofing—A much cheaper roof for temporary or semi-temporary buildings may be built of ready roll roofing of asphalt-saturated felt. Such a roof is adapted to all inclines greater than a 4-in. pitch and if given a coat of roofing cement every four or five years will last a long time, provided the felts used are of first class quality. Such roofs are given "Class B" rating by the National Board of Fire Underwriters if of asbestos asphalt felt and "Class C" otherwise.

Clay Tile—Twenty years ago some tile roofs in the northern part of the country gave trouble but at the present time many such roofs are entirely satisfactory and their present condition indicates that they will be

A Tile Roof Adds a Finishing Touch to a Well-Constructed Building.

permanent. There is perhaps no other roofing material that contributes so much to the beauty and dignity of a structure as some form of tile. It is a permanent and comparatively expensive material, hence every precaution should be taken to insure maximum service.

Corrugated Iron—Corrugated galvanized iron roofing may be used, nailed direct to the purlins and, where condensation is not objectionable, is satisfactory. No. 24 gage should be the minimum used with corrugations 2½ in. between centers. This roofing can be used on any pitch greater than 6 in. per ft. and for flatter roofs by increasing the horizontal laps.

Asbestos-Protected Metal—Asbestos-protected metal is made of flat sheet dipped in hot asphalt and covered with asbestos felt. Roofs of this material are in service and should prove to be durable and good. Where built under contract an inspector thoroughly familiar with the best practice should be constantly on the job.

Built-Up Smooth Surface Roofs—For inclines greater than 2 in. per ft. a roof built of one layer of 60 lb. per square, asphalt-saturated felt and two layers of 14 lb. asphalt-saturated felt can be used. Such a roof, built of reliable felts with alternate layers of asphalt roofing cement, is practically permanent and adapted to surfaces from those perfectly flat to inclines up to 12 in. per ft. It is of the greatest importance that the asphalt cement be procured from a reliable manufacturer, for asphalt cements are made of a combination of materials and vary all the way from worthless to first class. Roofs of this type, when built of asphalt saturated asbestos felt, are given the "Class A" rating by the National Board of Fire Underwriters.

Galvanized Iron—Galvanized iron makes an economical roof for temporary buildings as no roof sheathing is required. If covered with alternate layers of hot asphalt and asbestos felt so that all parts of the metal are completely shut away from the air it may prove to be a durable material and buildings so roofed are being watched with interest.

Zinc—Corrugated zinc sheets have made a good record so far as information is available, but the use of zinc for this purpose has not as yet been sufficiently general to establish its relative value.

Corrugated Asbestos—In corrugated sheets asbestos makes an excellent roof for some shop buildings. It possesses many of the good qualities of corrugated iron and is not affected by rust or gases such as quickly destroy sheet iron in engine houses.

Concrete—Except for the fact that in cold weather condensation occurs on its under surface, concrete would be the ideal roof covering for shops and engine houses. Concrete roofs are of slabs reinforced with metal, either poured or precast; and also instead of pouring, the cement, sand and water are forced by compressed air through a hose onto the previously-placed reinforcing. The poured concrete roof may also be used without felt covering by coating it with asphalt cement, but it is the usual practice to cover such roofs with a built-up roof, either smooth surfaced or covered with slag or gravel.

Committee: K. Peabody, (N. Y. C.) chairman; L. P. Kimball, (B. & O.) vice-chairman; I. C. Crawford (D. & R. G. W.); E. P. Self (L. I.); P. Aagaard (I. C.); F. O. Condon (C. N. R.); H. I. Benjamin (S. P.), and John Harden (M. C.).

Discussion

In the discussion of this report it was evident that while wooden shingles have disadvantages they are still widely used. H. I. Benjamin, (S. P.) told of the general use of white cedar shingles on his road, particularly in Oregon where the rainfall is heavy. He said that although these shingles are not dipped they give very satisfactory service. C. A. Lichty, (C. & N. W.) expressed the opinion that western shingles are of a higher grade than eastern shingles owing to the fact that they contain more natural pitch. E. E. Clothier, (C. M. & St. P.) stated that it was his experience that shingles in extremely dry territory have a tendency to curl while in wet localities they give very satisfactory service. He also stated that the poor quality of shingles being received now was due to the fact that a large number are being made from stumpage.

Prepared shingles were commented upon favorably in general although, C. P. Self, (L. I.) stated that a number of shingles of this type had shown a tendency to curl. A. I. Gauthier, (B. & M.) also told of satisfactory installations of this type of roofing, although he stated that in order to overcome the curling tendency they no longer used prepared shingles in strip form.

Slate roofs were reported as giving satisfactory service. J. E. Buckley, (B. & M.) told of the use of Vermont slate on his road and recommended a pitch of 4 in. in 12 in. for slate roofs. J. D. Voorheis, (Wabash) cited several instances on his road where slate roofs had been in service for 30 years without repair.

Tin roofs in general were not recommended owing to the poor class of metal now available and the difficulty in making repairs. Instances were, however, men-

tioned of metal shingles that had given good service, W. T. Krausch, (C. B. & Q.) reported one roof which, while frequently repaired, lasted for 19 years.

Roll roofing was commented upon favorably for use on minor buildings. W. T. Krausch stressed the importance of care in the selection of materials, the type of foundations and the need for periodical and thorough inspection. F. H. Masters, (E. J. & E.) stated that it would be advisable to renew many roofs which require heavy maintenance and that it might be well to put more into the original cost of a roof with a view of decreasing its maintenance cost.

Public Relations Work By the Bridge and Building Forces

By W. D. FAUCETTE
Chief Engineer, Seaboard Air Line

ALL of us are members of one great transportation family. I might say that we belong to the master haulers' association, because our business, while touching upon almost every phase of human activity, and while it has invested in it probably more money than any other general industry, produces a product which cannot be seen, and once it has been produced, the object shows no particular sign of production; yet, we know that for practically every article we have produced transportation and we have used it as a factor in every commodity that exists today. We rely on the general public in their organized sense, such as the state, to grant us a charter for our very existence and powers. We draw from the population money for hauling them and their produce; without their patronage our business would fail, and without us they would fail. We are, therefore, co-operative workers. We are a part of the body politic, and, specialists as we may be, we must take a lively interest in our contact with our fellow citizens.

We speak of the "policy" of the management in the usual terms in which we refer to some abstract or absent person, who is to mold and shape our destiny. This is true along certain financial lines, and this may be true in part along certain public lines. But the question of local contact with the public is, in a degree, a personal equation.

Co-operate With the Public

Say what you may in regard to the fact that you are not always interested in what the public thinks of your business or your efforts, you are an important part of the quasi public transportation machine. You are engaged in that section of this business that has to do with the safety of the machine. Among the hundreds and thousands of men in the bridge and building departments of the railroads, some must come in contact with different parts of society, and they either leave a good impression or they leave a bad impression. Regardless of how little we think that we may influence or help others, there is still an immeasurable and insensible influence left after each contact of one person with another.

For the welfare of our company and the stockholders which we serve, it is incumbent upon us, in addition to performing well the duties which are required of us as co-workers, that we carry with us a human touch, a co-operative spirit, not only in the family relations, but in our public relations. We are citizens and tax payers of every town and community we enter. We want to be neighborly and we want to be helpful. You and your assistants and subordinates no doubt have homes in towns all along the line. What you do and what they do in public relations is the measure of how your railroad is esteemed. You are the pulse at times. As a practical matter, how many times do many of us come in contact with the city or town officials, the mayors, the city managers, parts of the public. The day of our being isolated and the day of not taking these people into a reasonable confidence is over.

At times a few words of explanation as to our business, or as to the reason for delay or for non-action, or a suggestion of co-operation, may stop and cure a situation that we least expect. I have seen cases where an indifferent remark on the part of someone connected with departmental duties has caused an irritation which should never have existed. We all have our shortcomings in this direction, and we should take a considerate attitude towards the laymen, the passengers and those with whom we may live and do business. You have no idea of the measure of good that this may bring to your company.

We Are Judged by Personal Contact

I recall a case a few years ago where a salesman called on an official in one of the departments you represent and received a very cordial reception. After he left and went to his hotel, he wrote two letters, one to his company and the other to the party on whom he called with respect to some business matter and by mistake he crossed the envelopes in sealing. In the letter to his company, he stated with utter frankness and with truth, that while he had received no business, he did get a most cordial and friendly welcome to the railroad offices. Now, this is trifling, but multiply that feeling by 100,000 people. I dare say that every day each of you come in contact with at least one intelligent person connected with some public activity. In 30 days this association of 600 members would have 18,000 contacts and in 12 months you would have made 216,000 personal contacts with the public, most of them with people who are well enough up in the world to be directing the affairs or dealings of some business or association.

You can readily see that this is not a matter to be lightly laid aside. Therefore, may I urge the consideration of this thought upon you. You are part of the management. What profit is it to our public relations department if the gospel of its efforts is not reinforced and carried on by those in the working departments of the railroad? To your subordinates and to the employees of the intelligent class, who 25 years from today must carry on the efforts which most of us have undertaken, I feel that we can, with great return, spread this simple gospel of cordial relations with the public and to each other in our departmental work, which we are undertaking.

The Problem of the Highway Bridge

Heretofore, we have been concerned chiefly with the question of a bridge strong enough to carry the locomotives and cars over a stream or a road. Now we are interested in the automobile and truck. You will recall that less than 20 years ago the maximum load

to be carried over our road or bridges was probably a log cart, a wagon load of grain, corn or forestry products, probably a load which could be drawn by two or four horses or a team of oxen, which load moved over these roads and bridges at a slow speed. The present seven-passenger car on four wheels will probably weigh 4,400 lb. The laws of one of our southern states limits the aggregate weight of vehicles at not to exceed 16,000 lb. on each axle.

In the construction of new bridges and the rebuilding of old bridges, there must be a concurrent consideration of the present movement of these loads over roads and bridges and of what the increasing loads of today are and what may be legally permitted. In some parts of the country, where new roads are projected, especially by the state and county, wooden bridges may be built or may be replaced and, therefore, we must carefully consider if the design of these new wooden structures is going to meet modern traffic. Of course, each state may regulate the maximum loads on axles by law, but I recall one particular state in which there is at present no law regulating the weight of motor vehicles. Picture to yourself three or four buggies or farm wagons following each other across one of our wooden bridges or down one of our roads 20 years ago, and in contrast, in close relation to each other, three or four heavy trucks, or probably a dozen of them, loaded with stone, gravel, steel products, cast iron pipe, furniture or any other commodity, occasionally interspersed with a touring car of heavy capacity, all running close to each other, passing over new roads recently converted into highways. I am bringing this to your attention as one of the modern day problems, so that when we are called upon to give consideration to the construction of a new bridge or the renewal of a wooden structure, broad consideration be given the question of what traffic that avenue or passage will invite over it. It is not always sufficient to say that local traffic may be limited to light trucks, because any through thoroughfare invites traffic from remote states and as there is no rigid censorship of light trucks, our consideration of this problem must be broad.

The Use of Compressed Air in Bridge and Building Work

REPORT OF COMMITTEE

COMPRESSED air has been used with increasing effectiveness by bridge and building workers for 30 years or more. Each year finds some new uses. It is the aim of this report to show how it is used in bridge and building work today to save time and money by its efficiency. The uses of compressed air in the cement gun and spray painting are merely mentioned, as other committee reports have considered them in more detail.

The first sources of compressed air supply were the plants located in the major terminals. Such a source of supply is very convenient when working in the vicinity. Short pipe and hose connections to existing lines enable maintenance forces to secure air over a large area in which there is usually a great deal of work.

The second source of compressed air known and used by railway men is the locomotive compressor. It is often convenient to attach a hose feeding several small tools to the train line of a work engine or even an idle engine at a terminal. Another source of pneumatic power in some localities is in the electro-pneumatic interlocking plants. As the pressure in these lines is usually lower than that best suited to compressed air tools, to get good operation from this source of power, tools designed for 50 lb. pressure should be obtained.

The major source of air for bridge and building work, however, is the portable compressor, operated by steam, electricity, or gasoline. These are available in a variety of sizes and mountings so that almost every requirement may be met. The steam compressor is seldom used, except in the larger sizes.

Electric power is not usually available at the location of most bridge jobs, except on lines operated by electric power. The electric motor driven compressor is a very satisfactory tool and requires little attention and maintenance.

Portable Air Compressors

The type of portable compressor generally used is gasoline driven, and plants are available in size to fit the varying needs. These compressors may be obtained in a variety of mountings. The most common for railroad use is that on steel wheels with a pivoted front axle. This type may be easily loaded on a car with a runway and is easily movable about the job with a few men, or from job to job along the highway with a motor truck. A somewhat cheaper machine is mounted merely on skids. This is not so movable, but can be handled with rollers or a crane without much delay.

A great number of compressors used in the track department are mounted on flanged wheels so that they are easily transported along the track. Most manufacturers have types mounted on flanged wheels that have a gear connection which makes them self-propelling. Bridge and building men may have occasion to use the compressors assigned to the track department in seasons when tie tamping does not demand their use. The smaller sizes only are furnished in such a mounting, but the larger ones can be had with rubber tired wheels for rapid movement along the highways, or roads around the buildings at a terminal.

With all the portable compressors it is essential that the automatic operation be maintained. When supplied with fuel, oil and water and started, the compressor should care for itself for long running periods, with only occasional attention from the foreman or operator.

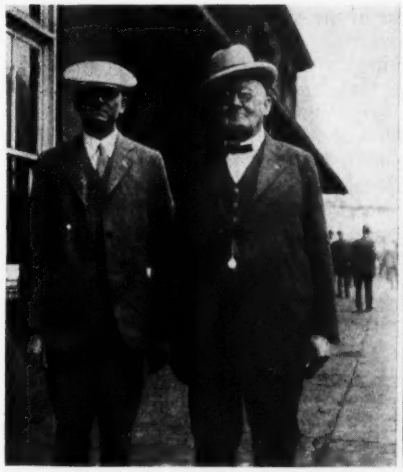
Pipe lines should be of a size proportionate to the air comsumption of the tools supplied. To illustrate the pressure drop in pipe lines, air delivered at 100 lb. pressure at the compressor at the rate of 100 cu. ft. of free air per minute loses 1.15 lb. per 1,000 ft. in a 2-in. pipe, 5.1 lb. in a 1½-in. pipe, and 13.2 lb. in a 1¼-in. pipe. Each elbow, tee or valve also reduces the pressure as much as several feet of extra pipe.

Uses for Compressed Air

Steel bridge erection has always suggested the use of riveting hammers. A variety of sizes to drive the several sizes of rivets found on bridges and buildings are available. The use of these hammers is so familiar that it needs no further consideration here.

Steel bridge work calls frequently for drilling and reaming. A pneumatic drill will make a ⅞-in. hole in a ½-in. plate in 30 sec. as compared with 20 min. by hand work.

Air chipping hammers are the quickest and cheapest



Two Representatives of the Southern Railway.

"Dick" Knowles of the I. C. Was There Too.

F. H. Masters and A. J. Filkins Talking It Over.

means of cutting out old rivets and steel. In the erection of steel tanks, a calking tool for the hammer gives an economical means of making tight joints.

In timber bridge work the air drilling machine facilitates the framing. A 7/8-in. hole can be drilled through 24-in. in 40 sec., a small fraction of the time consumed by the hand operated ship auger. Attachments for this tool will operate to tighten lag screws and screw spikes. Drills and wood borers use 80 to 90 lb., pressure and consume slightly more air than the hammers.

Compressed air operates several tools that are handy and economical in foundation work. Jack hammers and tripod drills are faster and cheaper than hand drills for making holes in ledge rock or boulders for blasting. In tearing out old masonry and concrete structures, air drills more than justify their cost if the job is at all large. The same tool used for the jack hammer drill will operate the steels for demolition work. This tool is generally called a paving buster. Compared with hand methods, the saving is over 70 per cent. These tools operate on 60 to 75-lb., pressure. The sharp steel in the jack hammer is used to great advantage in picking frozen ground.

Other Types of Equipment

There are a number of convenient attachments to the hammer for various types of construction work. One of the recent developments is a spade that eliminates hand picking in trenching work. Another is the back-fill tamper, a light but effective tool. A rather sharp edged tool designed for cutting asphalt is convenient in cutting out mastic waterproofing in bridge replacements.

Similar to the compressed air drills are rotating devices operating wire brushes for cleaning steel bridges for painting. Carborundum wheels on the same tool are very convenient and economical in grinding down steel plates for a tight fit.

Compressed air has one of its most important uses in the sand blast. This is used for cleaning steel work ready for painting. The sand blast is used to advantage also in cleaning the surface of buildings. The cost is about two cents per square foot, varying with the type of surface and amount of scaffolding required.

When compressed air is available on a job, loads up to 1,000 lb. may be lifted with a small air turbine hoist. These hoists may be equipped with either winch head or rope drum. The former is handy in spotting cars on a construction siding. Such a hoist can also be used to draw culvert pipe into place.

Another type of hoist is the cylinder hoist. When mounted on a trolley or boom it can handle timbers and small structural members in the shop or yard.

Similar to spray painting is the application of waterproofing to the back of walls and top of slab bridges by compressed air. The force behind this spray gets the waterproofing into the pores of the concrete. Air pressure of 75 lb., is necessary for good work.

It is recommended that bridge and building gangs be provided with portable compressors supplied with hammer and drilling tools having the various attachments useful to the type of gang considered. These tools will enable the small gang to perform more than the larger one of a few years ago at a saving large enough to more than justify the cost of the labor saving devices.

Committee: F. A. Dever (Penna.) chairman, William Shively (C. R. R. of N. J.), G. E. Bitz (N. Y. C.), Albert Fink (D. L. & W.), Adolph Yappen (C. M. & St. P.), J. W. Colcomb (L. V.), A. B. Scowden (B. & O.) and F. H. Lehrman (C. & N. W.).

Discussion

The discussion on this report showed clearly the adaptability and wide-spread use of compressed air in bridge work. Referring to a statement in the report regrading the burning of holes with the acetylene torch, F. A. Taylor, (B. & O.) asked if this was often resorted to. R. W. Johnson, (C. M. & St. P.) stated that it was done on his road in making holes for filler plates and sometimes to enlarge holes.

Referring to the first part of this report in which sizes of compressors in general use, their approximate weight and the number of devices they will operate were listed, A. B. Scowden, (B. & O.) suggested that the rated capacities of these various air compressors be added to the report, it being his thought that the average bridge man speaks of compressors in terms of capacity rather than size.

In discussing the use of air operated tools, a number of members cited instances of the successful and economical use of chipping hammers, rock drills, jack hammers, etc., as well as the use of compressed air in sand blasting, paint spraying and the placing of concrete. In connection with these statements, C. W. Wright (L. I.) pointed out the necessity of effecting actual savings in the use of air operated tools and sug-

gested the careful watching of bridge gangs with the view of reducing their size in order to effect real economy. R. W. Johnson took exception to that section of the report which recommended that automatically operated compressors be operated without direct supervision, or that a low priced man be employed for this work, stating that in large cities it was often necessary to employ a licensed hoisting engineer for this work and in the second place, that he had found it advisable to have a full time operator, who might assist in doing other work in a small way, so that minimum delay would occur to the operation of air tools if any breakdown or trouble should occur in the operation of the compressor. Regarding the loss of air pressure in long pipe lines, Mr. Johnson described a practice used on his road of installing a storage tank near the work, which he has found eliminates a large amount of the loss in air pressure. Mr. Johnson expressed his preference for the trigger on the outside of the hammer, stating that it was often difficult to operate the inside trigger when gloves were used in cold weather. Differing with him on this point, Mr. Wright stated that he preferred the inside trigger as it was protected from damage if the hammer should be dropped.

The Application of Protective Coatings to Structural Steel

REPORT OF COMMITTEE

TODAY, and during the past few years, the big development in the application of protective coatings has been the paint spray machine and to get as much information on the subject as was possible a questionnaire was prepared and sent to officers of 97 railroads, covering protective coatings under the heads of paints, bituminous coatings, concrete and cement coatings, and special coatings or coverings.

Answers to this questionnaire were received from 49 railroads in this country and Canada, and 2 in foreign countries, with a total mileage of approximately 164,300.

The first five items of the questionnaire had to do with the use of the spray.

To the question "How is paint applied (brush or spray)?", 31 replies stated "brush only" and 18 answered both; although 11 of those who still use the brush only are contemplating the immediate use of the spray, or are experimenting with it.

To a further development of this question "If the latter, do you use it for all types of structures?", 11 out of 16 replied that they do use or would use it for all types; one uses it for the first coat only and one uses it for inaccessible parts of bridges.

To the question "If you spray paint, what kind of machine do you use?", 7 replied that their machines were home-made and the remaining 11, who use, and the 11 contemplating the use of spray, employ machines made by 7 or 8 different manufacturers.

To the question "Do you consider spray as good as brush paint? If not, state why," the answers were as follows from those using the spray, intending to use it or experimenting with it: No, 6; yes, 15; can't say, 4; non-committal, 1; and not answered, 13.

The answers received show a definite trend towards the use of the spray in applying paint to structural steel for practically half of those answering are using or intending to use this method of application.

It seems to be good practice in the use of the spray to have the operators protected by gas masks or sponges, so that they will not breathe the fine spray, and to have them relieve each other, although all this is largely dependent on the nature of each job.

There is a very wide division of opinion, even among those who are actually using both methods, as to the quality of the coat of paint put on with the spray.

Spray and Brush Painting Compared

Following are the comments made against spray painting: Some paint is wasted, particularly in the wind and when painting light truss bridges. The coat is applied unevenly. Edges of plates and angles are not properly covered and must be gone over with a brush. The film is porous. There is an added expense in moving equipment. The surface is built up of a series of drops superimposed on each other with spaces between through which moisture can penetrate and attack the steel.

Comments made in favor of the spray range from an enthusiastic "far superior" to a more conservative "spray does good work," "it is more rapid," "it reaches inacessible places," "it is better on large surfaces." Digesting all of the replies received and from conversations with paint men and spray manufacturers we can come to some conclusions as to the merits and defects of spray painting.

Advantages of Spray Painting

The great advantage of the spray is the rapidity of applying the paint which can be put on 2 to 4 times faster than with the brush. However, applying the paint to the surface to be protected and spreading it out is only a part of a general job of painting. The surfaces to be painted have to be cleaned and scaffolding of practically the same strength has to be erected for either method and then taken down again. There is also the cost of the paint itself which, taking everything into consideration, is without doubt more expensive with the spray than the brush method of application on account of waste. The real saving is not then so apparent and can be realized only on structures favorable for spray painting.

Paint sprayed on will reach parts inaccessible or difficult to reach with a brush and this is one real advantage. A coat of spray paint properly applied will cover a surface more evenly than that put on with a brush. This is especially noticeable around rivet heads. When a paint program is unusually large, the use of the spray machine will hasten the work and enable the painting gangs to complete the work during the most favorable part of the painting season.

As stated before, some paint is wasted even under favorable circumstances, and in windy weather this may be excessive. Edges of angles and plates have to be gone over with a brush. There is more equipment to move around and transport from job to job.

The committee was unable to get any definite information as to the relative permanence of spray and brush painting as it has no record of a paint film put on by means of compressed air under actual field conditions on a bridge directly comparable with the film put on

by the brush method for life and protective qualities.

However, assuming that the spray gun can apply coatings of paint that will give as satisfactory service as those applied with a brush, the committee feels that a good spray outfit ought to be a regular part of a paint crew's equipment. It will be found useful for applying paint on inaccessible places. In some places the brush can supplement the spray, while in other places the spray can supplement the brush.

Contact and Company Force Painting

To the question "Is your painting, contracted for or done by your own forces?", 30 replied that it was done by their own forces; 2 by contract; 16 said both and 1 did not answer.

To the question "If contracted for, is an inspector kept constantly on the job?", 5 answered no; 12 answered yes, and 2 said it depends on the job.

The question of cleaning was covered by "What means do you employ in preparing steel for repainting?" The majority replied that all cleaning was done by hand by means of chipping hammers, scrapers, wire brushes, chisels and flogging hammers. A few used air hammers and 13 replied that the sand blast was used on badly corroded metal. A few replied that they never let metal get in such shape as to require a sand blast for cleaning.

The question of applying the priming coat in the fabricating shop is important and may not receive as much attention as it ought to. The first coat put on the metal serves as a base for all the succeeding coats. If it adheres well it is never removed, as it is good practice in cleaning to leave on all old paint that adheres firmly. The more of this priming coat that remains the better is the preservation of the metal. It behooves bridge engineers to make a personal inspection of the painting in bridge shops to see that the priming coat is applied as well as conditions will permit.

Another question dealt with spot painting: "Do you spot paint, (a) to carry a structure over, (b) ahead of general painting?" To each question a majority replied that they do spot paint. To (a) 32 roads answered yes, 8 no, 7 seldom, and 2 did not answer. To (b) 25 answered yes, 9 no, 2 seldom, and 13 did not reply.

Committee: R. W. Johnson, chairman (C. M. & St. P.); H. H. Harmon, vice-chairman (B. & L. E.); H. B. Stuart (G. T.); Martin Kane (D. & H.); J. D. Voorheis (Wabash); and J P. Smallenberger (Erie).

Discussion

The increasing use of the paint spray was evidenced by those who discussed this report. A. B. Scowden, (B. & O.) and T. E. O'Brien, (D. & H.) told of replacing heavy, awkward paint spraying machines with modern outfits which are fitted with chippers and rotary brushes for cleaning work.

In referring to the cleaning of bridges, A. I. Gauthier, (B. & M.) deprecated the practice of allowing bridges to get in such a condition that the sand blast is necessary, recommending more frequent painting as more economical. The successful use of the sand blast was reported in several cases, H. I. Benjamin, (So. Pac.) citing an instance where from ¼-in. to 1-in. of barnacles on a steel span which had been knocked into the water, were removed by this method, and T. E. O'Brien mentioning the good results obtained with the sand blast on his road in locations which it was not possible to reach with the chisel. Mr. O'Brien raised the question as to how much of the old paint should be removed in cleaning, in reply to which the consensus of opinion, as expressed, was to clean only where necessary and leave as much of the original coat as closely adhered to the metal.

The subject of contract painting brought forth considerable discussion. J. D. Voorheis, (Wabash) and C. F. Weir (P. M.) cited experiences on their roads where such work was entirely unsatisfactory, in spite of the employment of capable inspectors. A. I. Gauthier, (B. & M.) also reported poor contract work on about 20 bridges painted just after the war. A. B. Scowden, (B. & O.) stated that they had had some success with this practice, particularly on interior work, the tendency of the contractor being to slight bridge painting and in particular the cleaning work involved. W. T. Krausch, (C. B. & Q.) outlined the difficulties encountered in securing accurate bids on bridge painting, stating that in particular it was difficult for the contractor to estimate accurately the amount of cleaning and auxiliary work, which if underestimated, led invariably to skimping of the work in some detail unless the work was in charge of a thoroughly reliable contractor.

The Use of Creosoted Timber

REPORT OF COMMITTEE

[*The committee assigned to the subject designated by the above heading presented a general resumè of the present status of timber preservation on American railways. Excerpts from the report relating definitely to the use of creosoted wood on railway bridges are given below.—Editor.*]

TIMBER has been used for structural purposes since the earliest times and is today one of our most important materials of construction. It properties of light weight, strength, durability, adaptability and low cost combine to make it in ideal construction material. The most serious disadvantage is its susceptibility to decay when used in exposed places and not protected from the weather. This disadvantage is largely overcome by injecting proper preservatives into the wood.

The life of both treated and untreated timbers varies, depending on climate, species and grades of timber used. There are examples of creosoted timber structures that have lasted 40 or more years and still retain a large amount of the original timber in good condition. Other structures have failed in less than 20 years. Of the latter class investigation has shown that the short life has been due to imperfect knowledge of handling the timber either before or after treatment. The art of creosoting timbers and of handling creosoted timber has improved so that we can safely predict an average life of 30 or more years for creosoted timber in railway bridges.

The annual charges for a structure are the interest on the original investment, a sinking fund to replace the structure at the end of its useful life, and the maintenance charges. A creosoted trestle will generally not cost over 40 per cent more than an untreated trestle of the same design. Assuming interest at six per cent and a maintenance allowance equal to

one-half the cost of the structure, spread over the life of the structure, the annual charge of interest, sinking fund and maintenance for an untreated trestle costing $1,000 and lasting 10 years is $185, and the annual charge for a creosoted trestle costing $1,400 and lasting 25 years is $137, or if the creosoted trestle will last 35 years the annual charge is $117. Another way of considering the matter is to assume an untreated trestle costing $1,000 and good for 10 years; then the life of a creosoted trestle costing $1,400 would have to be only 16½ years for the same annual cost. These figures indicate marked economy in the use of creosoted timber for trestles.

There are places where it is found economical to use creosoted timber instead of concrete or steel. For instance, in some structures such as wharves and docks, it is frequently found that changing conditions make remodeling or rebuilding advisable after a few years. There is no kind of structure that can be remodeled as readily as timber, or if torn down, will yield as much material that can be recovered and used. If necessary to tear down a concrete structure, the material as well as the structure itself is destroyed.

A committee of the American Railway Engineering Association made an exhaustive study and concluded that creosoted timber trestles are more economical than concrete, except when the cost of the concrete structure is less than one and one-half times the cost of the wooden structure.

All structural timber, if properly handled during treatment, can be used with the same working stresses as untreated timber. The steam seasoning of timber reduces its strength and all timber to be creosoted should be air seasoned. In the treatment of Douglas fir which does not take the oil readily it has been found that good results can be obtained by treating it green, by preliminary boiling in creosote oil under a vacuum. This removed the moisture and prepares it for further treatment.

It is recommended that all timbers that are to be creosoted be framed entirely before treatment wherever possible. This is being done to a considerable extent but not nearly so much as its importance warrants. A complete detail framing plan, including the bolt holes can be worked out for many creosoted structures in the same manner as plans for fabricating steel and the timber completely framed and marked before creosoting. Ties are being dapped and drilled before treatment by large users of creosoted ties.

As far as the selection of woods to be creosoted is concerned, any timber that has the structural requirements for the use intended can be creosoted, and this opens a big field for the utilization of many species of timbers not otherwise suitable on account of their short life. When timber is to be creosoted, it is not necessary to confine specifications to heartwood. The sapwood before decay is structurally as strong as the heartwood and takes the creosote oil much better, so that it is an advantage to utilize that part of the timber instead of wasting it. The timber should be selected for its suitability for the purposes intended and then creosoted for the prevention of decay.

Committee: C. S. Heritage (K. C. S.), chairman; W. A. Clark (D. & I. R. R.), D. T. Rintoul (S. P.), J. E. Coffin (Sou.), I. L. Simmons (C. R. I. & P.), A. J. James (A. T. & S. F.).

Discussion

The discussion on this report clearly indicated the advisability of using creosoted materials in bridge work. A. I. Gauthier (B. & M.) started the discussion by asking whether it was advisable to place a creosoted timber deck on untreated white oak piling or bents. In reply C. S. Heritage (K. C. S.) stated that it would be better to place an untreated deck on treated piles. A. B. Scowden (B. & O.) stated that the untreated piling would have to be renewed some years prior to the renewal of the treated deck. J. J. Taylor (K. C. S.) cited an experience of this nature, in which untreated piling were used to effect economy but that they had proved so unsatisfactory that it was now necessary to renew the piling long in advance of the time that they had expected this would be necessary. He further stated that fully creosoted structures on his road were giving no trouble. C. W. McCandless (So. Pac.) cited the case of a 600-ft. creosoted Douglas fir trestle which has been in service for 28 years without repair and which now requires only the renewal of a few bents.

A. I. Gauthier mentioned the difficulty he has experienced with the splitting of creosoted oak piles and asked if it was thought that this was due to the treatment. The replies to this indicated that the splitting of oak was quite common and that it was due more to the method of seasoning rather than to the method of treatment. Along with the other advantages mentioned through the use of creosoted material, H. I. Benjamin stated that creosoted piling was the best safeguard against the attack of marine borers and that they get from four to five times the life from treated piles that they originally got from untreated piles.

Supply Manufacturers Present Large Exhibit

SIXTY manufacturers of materials and equipment for the construction and maintenance of bridges, buildings and water stations presented an exhibit of their products in the lobby of the hotel under the auspices of the Bridge and Building Supply Men's Association. This was the largest and most successful exhibit ever presented by the association, there being ten more companies represented than in the peak year of 1925. While a large number of the individual exhibits were in the form of samples, and models of materials and equipment, photographs and literature, an increasingly large number of manufactures had actual products on display.

The officers during the past year were as follows: President, D. J. Higgins, American Valve & Meter Company, Chicago; vice-president, John E. Nelson, Joseph E. Nelson & Sons, Chicago; treasurer, B. J. Wilson, The Pocket List of Railroad Officials, Chicago; secretary, F. M. Condit, Fairbanks, Morse & Co., Chicago; honorary director, A. J. Filkins, Paul Dickinson, Inc., Chicago; members executive committee: W. D. Waugh, Detroit Graphite Company, St. Louis Mo.; J. W. Shoop, The Lehon Company, Chicago; D. A. Hultgren, Massy Concrete Products Corporation, Chicago; O. T. Snow, T. W. Snow Construction Company, Chicago; R. F. Repasz, William Robertson & Co., Chicago, and D. A. Evans, Kaustine Company, Inc., Buffalo, N. Y.

At the annual meeting held on Thursday morning the following officers were selected for the ensuing year

as well as members of the executive committee for terms of one, two and three years; president, John E. Nelson, Joseph E. Nelson & Sons, Chicago; vice-president, B. J. Wilson, Pocket List of Railroad Officials, Chicago; treasurer, F. M. Condit, Fairbanks, Morse & Co., Chicago; secretary, D. A. Hultgren, Massey Concrete Products Corporation, Chicago. Member of the executive committee: for the year ending 1927, O. T. Snow, T. W. Snow Construction Company, Chicago, and W. D. Waugh, Detroit Graphite Company, St. Louis, Mo.; for two years ending 1928, R. F. Repasz, William Roberston & Co., Chicago, and D. A. Evans, Kaustine Company, Buffalo; for three years ending 1929, G. C. Mills, W. S. Zitterell Company, Webster City, Iowa, and P. C. Jacobs, Johns-Manville Company, Chicago.

The companies represented at the exhibit, together with the character of their exhibits and their representatives were as follows:

List of Exhibitors

American Hoist & Derrick Company, St. Paul, Minn.

American Tar Products Company, Pittsburgh, Pa.; literature; D. S. Snow.

American Railway Hydrant & Valve Company, Stapleton, S. I., N. Y.; valves; W. Volkhardt.

American Valve & Meter Company, Cincinnati, Ohio; model of water column with telescopic spout; J. T. McGarry, D. J. Higgins and Cecil Stevens.

Barber Asphalt Company, Philadelphia, Pa.

Barrett Company, New York; literature; F. S. Nicols.

Beaver Products Company, Inc., Chicago; roofing, wallboard, plaster and shingles; H. M. Butters.

Binks Spray Equipment Company, Chicago; paint spraying equipment; O. D. Soellner and J. A. George.

Buda Company, Harvey, Ill.

Carter Bloxonend Flooring Company, Kansas City, Mo.; samples of built-up wood block flooring, literature and photographs; A. E. Giese and A. N. Dobson.

Celotex Company, Chicago.

Chicago Bridge & Iron Works, Chicago; photographs and literature; E. P. Shelton.

Cleveland Pneumatic Tool Company, Cleveland, Ohio; hammers, riveters, wood and metal boring drills, rock drills and concrete breakers, air valves and hose couplings; B. H. Tripp.

Cook, Inc., A. D., Lawrenceburg, Ind.; deep well equipment; Charles F. Cole, J. F. Freeman, J. Q. Peeples and W. C. Gentry.

Dearborn Chemical Company, Chicago; samples of rust inhibitor; W. D. Bennett and F. H. Robison.

Detroit Graphite Company, St. Louis, Mo.; literature; W. D. Waugh, A. B. Edge and J. R. C. Hintz.

Detroit Steel Products Company, Detroit, Mich.

Dickinson, Paul, Inc., Chicago; models of cast iron camp car jack, ventilators and chimneys for small buildings, scuppers, smoke protection plates and exhaust heads; A. J. Filkins and A. E. Engman.

Dixon Crucible Company, Joseph, Jersey City, N. J.; graphite products; H. A. Nealley and W. A. Housten.

Duff Manufacturing Company, New York; jacks; P. G. O'Hara, J. E. Stewart and W. G. Robb.

Dunham Company, C. A., Chicago; thermostatic radiator traps, float traps, strainers, radiator valves, medium pressure traps and lift fittings; L. W. Millar.

Fairbanks, Morse & Co., Chicago; literature; F. M. Condit, E. J. Coverdale, H. E. Vogel, B. S. Spaulding and H. L. Hilleary.

Fairmont Railway Motors, Inc., Fairmont, Minn.; motor car engine; E. R. Mason, S. D. Gibson and C. F. Green.

Federal Engineering Company, Chicago; John E. Nelson.

Hastings Signal & Equipment Company, Boston, Mass.; automatic tell-tale hanger and replacer and side clearances; Harry H. Nayor and Joseph E. Freeling.

High Grade Manufacturing Company, The, Cleveland, Ohio; literature and samples of roofing cement; J. N. Kinn and S. A. Baber.

Ingersoll Rand Company, New York; literature on bridge repair outfits; W. H. Armstrong and F. F. Hanly.

Insulite Company, The, Chicago; E. H. Batchelder.

Jenkins Brothers, New York; valves, gage glasses, car heating gaskets, sheet packing and discs; C. B. Yardley and W. J. Adams, Jr.

Jennison-Wright Company, Toledo, Ohio; creosoted wood blocks; G. E. Humphrey.

Johns-Manville, Inc., New York; samples of roofing, pipe and boiler insulations, packing shingles, corrugated siding and roofing, waterproofing, industrial flooring and smoke jacks; W. H. Lawrence, W. R. Bush, P. C. Jacobs, A. F. Eichhorn and F. J. Horne.

Jones Paint Company, The, Rome, N. Y.; roofing cement and glazing cement; A. DeWolfe Jones.

Jordan Company, O. F., East Chicago, Ind.; A. L. Greenabaum.

Kaustine Company, Inc., Buffalo, N. Y.

Kentucky Rock Asphalt Company, Louisville, Ky.; samples of rock asphalt, photographs and literature; W. F. Pollard.

Knickerbocker Roofing & Paving Company, Chicago.

Lehon Company, The, Chicago; samples of roofing and shingles, water-proofing and roof coatings; Tom Lehon, J. W. Shoop, E. T. Wade and F. T. Carpenter.

Lewis Asphalt Engineering Corporation, New York; samples of waterproofing, and literature; W. T. Kelley and P. R. Frank.

Lowe Brothers Company, The, Dayton Ohio; Langley Ingraham.

Massey Concrete Products Corporation, Chicago; photographs and literature; W. Lyle McDaniel, Charles Gilman, J. A. Higgs, Jr., and David A. Hultgren.

Murdock Manufacturing & Supply Company, The, Cincinnati, Ohio; hydrants, railway water service box and drinking fountains; J. C. Endebrock.

National Lead Company, New York; girder bridge model showing paint coats; F. M. Hartley, Jr., A. H. Sabin, C. L. Hass, W. S. Carlisle, D. Lewis Ireton and F. E. Dodge.

Nelson & Sons, Joseph E., Chicago; literature and photographs; John E. Nelson and I. B. Tanner.

Norton, A. O., Inc., Chicago; bridge jacks; W. R. Kelly and O. L. Wright.

Northwestern Motor Company, Eau Claire, Wis.; motor car parts, heavy duty transmission, photographs and literature; B. F. Frazier.

Patterson Company, W. W., Pittsburgh, Pa., tackle blocks; W. W. Patterson, Jr.

Patterson-Sargent Company, Cleveland, Ohio; H. V. McKedy, W. W. Huntley and W. H. McBride.

Peaslee-Gaulbert Company, Louisville, Ky.; paints; H. H. Mapother, Jr.

Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa.; literature; I. A. Bickelhaupt.

Pocket List of Railroad Officials, New York; publications; B. J. Wilson.

Railroad Water & Coal Handling Company, Chicago.

Robertson Company, H. H., Pittsburgh, Pa.; samples of protected metal roofing and siding, smoke jacks, ventilators, skylights and sash; A. R Gray and J. R. Sexton.

Robertson & Co., William, Chicago; cinder conveyor literature; R. F. Repasz.

Ruberoid Company, New York; Wm. S. Knoble.

Sherwin-Williams Company, Cleveland, Ohio; J. Schlintz.

Simmons-Boardman Publishing Company, Chicago; Ill.; copies of Railway Engineering and Maintenance, Railway Age and Railway Engineering and Maintenance Cyclopedia; E. T. Howson, F. C. Koch and N. D. Howard.

Snow Construction Company, T. W., Chicago; literature; O. T. Snow and B. S. Snow.

Templeton, Kenly & Co., Ltd., Chicago; bridge jacks; G. L. Mayer.

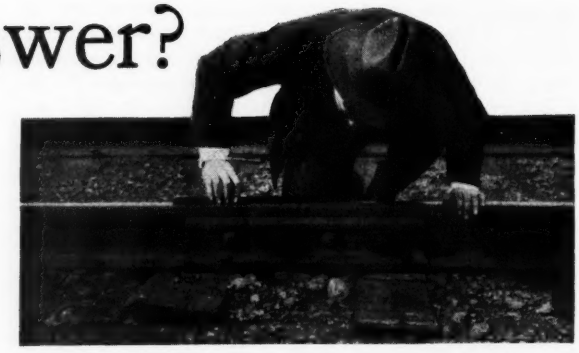
U. S. Wind Engine & Pump Company, Batavia, Ill.; literature; C. E. Ward.

Zitterell Company, W. J., Webster City, Iowa; photographs; Guy C. Mills.

America's Northernmost Station at Fairbanks, Alaska

What's the Answer?

What Our Readers Have to Say on Current Questions That Perplex Those Engaged in Maintaining Tracks, Structures and Water Supply Facilities



QUESTIONS TO BE ANSWERED IN THE JANUARY ISSUE

1. *What are the advantages, if any, of fastening tie plates to the ties by lag screws or spikes independent of the spikes that hold the rails in place?*

2. *In installing new pipe culverts how should the camber be varied to compensate for the height of the embankment and also for the bearing powers of different soil foundations?*

3. *The A.R.E.A. specifications for stone ballast provide for the acceptance of stone ranging from ½ in. to 1½ in. in size. From the standpoint of track maintenance towards which limit should the preponderance of the stone run?*

4. *Can wooden shingles be made fire resistant economically?*

5. *What precautions can be taken to avoid irritation of the skin when handling creosoted ties and what remedies will relieve this irritation?*

6. *Has excelsior proved a satisfactory filtration medium for water treating plants? What precaution and limitations should govern its use?*

7. *To what extent should rail ends be inspected for incipient bolt hole or end breaks when the angle bars are removed for renewal or other purposes?*

8. *What is the best method of waterproofing pedestrian subways at passenger stations?*

Nicked Rails Are Dangerous

What special precautions should be taken when the heads of rails have been nicked by the passage of a broken wheel?

Such Rails Should be Removed from High Speed Tracks

By C. W. Baldridge

Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

Most wheels which break and thereby nick the rails over which they pass are cast iron wheels. The nicks made by such broken wheels are usually narrow and deep for the first few revolutions of the wheel, and tend to become wider and of less depth as the sharp edges of the "breaks" crumble off from the repeated blows. Frequently, after a sharp broken edge of a wheel becomes dull another break in the wheel occurs, causing another sharp edge and another group of deep nicks. For this reason the trail of a broken wheel must be followed from end to end and the condition of all rails affected must be noted carefully.

If the nicking occurs in the base of the rail, it is advisable to remove the rail from the running track and get the rest of its usefulness in a side track where train and car movements are slow. If the nick is in the head of the rail and is deep and sharp, the rail should be removed from the running track and used in a siding. If it is not feasible to remove these nicked rails from the running track, joint bars should be applied, using the nick as the center of the joint and drilling and bolting the end holes only.

Nicks in the head of the rail which are shallow and wide will cause no trouble in the majority of cases, other than that due to the kink in the rail which usually results from the blow which made the chip, and rails containing only such nicks will usually remain in running tracks without failure as long as they would have lasted if not nicked. However, there is no way to tell just where the nick ceases to be dangerous, and no one can tell which rails will fail and which rails will last; consequently leaving rails that have been chipped or nicked in running tracks without applying joints amounts to gambling a possible train wreck with loss of lives against the cost of moving the damaged rails to a side track plus the difference in the value of their usefulness in a running track over their usefulness in a siding for such time as they might be made to last.

No broken rail should be jointed and left in a running track, but a chipped rail may be left in track with reasonable safety if protected against breaking, by having joints applied at the damaged spots. "When in doubt adopt the safe course."

The Danger from Nicked Rail is Not Always Understood

By Maintenance Engineer

Rails are damaged by the severe blows which they receive from the sharp corners of the broken portion of a car wheel, the damage depending to a large extent on whether or not the temperature is low as well as on the rigidity of the roadbed and track structure. Breakage of the rail is less apt to follow the nicking

of the head than when such injury occurs to the base, but there are exceptions to this in case of cold weather and an unyielding roadbed. Hence, to avoid taking chances all rails damaged in this manner, whether in the head or the base, should be changed out of high speed tracks, while only those having the deepest nicks need be changed out of low speed tracks.

Since a broken wheel is usually derailed before it has traveled any great distance, a close examination should be made of all rails from the point where the effects are first noted to the point where the wheel finally stopped, to ascertain if the bases of the rails have been injured, because these latter injuries are almost sure to cause broken rails. It has been found that even if the bases have not been nicked but are merely dented, they are liable to break at the points of injury in high speed tracks in time.

Cases have been known where a slight dent ½ in. long and less than 1-16 in. deep has failed after a lapse of several years. The chief danger from such defects is the tendency to break at more than one of these places, which are spaced not further apart than the circumference of the wheel, which in the case of a 33-in. wheel is equal to 8 2-3 ft. It is the second break that usually causes the most damage, due to the tendency of the wheels to throw a piece of rail out of position, causing a derailment.

The danger due to damaged rail bases is illustrated by the ease with which rails of any section may be broken by a few blows of a sledge, providing the base is first nicked by one or two cuts of a keen chisel, the nicks starting a fracture through the structure of the rail. Nicks on the head of the rail are not so apt to do this, owing to the greater amount of metal in the head, but the possibilities of accident are too great to allow such rails to remain in high speed tracks.

To show the serious danger arising from nicked steel, cases have been known where axles of derailed engines which have been nicked by striking rails or boulders along the track failed a few months after they had gone back into service. From this it will be seen that such injuries are a serious matter, where they occur on the head of the rail and in many cases this is not understood by trackmen due to their unfamiliarity of the ease with which steel that has been nicked may be broken.

Insulation for Roundhouse Roofs

Should the roofs of roundhouses be insulated?

Insulation Is Desirable in the North

By J. A. Stocker

Chief Engineer, Ohio Central Lines, New York Central, Columbus, Ohio

When we constructed our West Columbus roundhouse, we had the impression based on observation and reports, that a concrete slab roof would cause condensation of moisture in cold weather, which would result in water dripping onto the area below, and to overcome this we used building tile under our concrete slab. We have never had any trouble with condensation. Our roundhouse is well ventilated, and possibly ventilation has had as much to do with the dryness of the underside of the roof, as the roof construction itself. The two conditions together certainly have produced satisfactory results.

It seems to me that the roof construction of roundhouses will naturally vary somewhat with the climatic conditions. Insulation might not be necessary in the south, but where the winters are severe it would seem to be essential for concrete roofs. It is my opinion that ventilation is extremely important, whether the roundhouse is built in the north or the south and regardless of the type of roof construction. Trapped steam and gases in the upper part of the house immediately under the roof are sure to cause serious trouble.

Effect of Oiling Roadbed on the Efficiency of the Ballast

Does the spraying of the roadbed with oil to keep down the dust reduce the efficiency of the ballast?

Oiling the Roadbed Has Little Effect on the Ballast

By H. R. Clarke

General Inspector Permanent Way, Chicago, Burlington & Quincy, Chicago

For a number of years the practice of oiling the roadbed to keep down the dust has been followed, especially in the suburban territory. Recently the practice has been somewhat extended, the roadbed being oiled through certain station grounds, at road crossings and such locations where dust was found to be particularly annoying. It has not been found that the use of oil on the roadbed in this way has been detrimental to the ballast or has in any way reduced its efficiency; that is, there has been no indication at all that the oil worked down into the ballast and lubricated it, causing it to become shifty, a fear that has been expressed by some.

It has been found that the oiling of the roadbed, especially if continued for several years, forms a crust on the top of the ballast. This crust is practically waterproof, but is, of course, broken at the ties. Being waterproof between the ties and broken at the ties causes practically all the water which falls on the track to flow to the ties and enter the roadbed at that point, thus tending to concentrate the water immediately around the ties rather than permitting it to be distributed over the roadbed as a whole, as would be the case if the surface between the ties was not rendered waterproof. No particular trouble has been experienced in maintaining track under these conditions. It is possible, however, that this concentration of water close to the tie has a tendency to keep the ties in a damper state than would be the case otherwise, which would be especially objectionable in the case of untreated ties.

It has been found that the oiling of the roadbed destroys weeds, keeping it almost entirely free of vegetation of any kind. It has also been found that the oiling, probably due to the formation of the crust mentioned above, has a tendency to prevent dirt and foreign material such as cinders, coal dust, etc., from working down into the ballast. Due to this action, although the top inch or so of ballast may be quite foul, the same amount of foreign material does not work into the ballast that would otherwise be the case.

There is some difference of opinion as to the desirability of oiling the roadbed to keep down the dust, for the reason that it is only temporarily effective and that unless the oiling is repeated, when the roadbed again becomes dusty, conditions are aggravated by the fact that the dust which is then stirred up by passing trains is likely to be of an

oily nature due to contact with the oily roadbed. If oiling is considered desirable as a means of preventing dust, there is no reason why this practice should not be followed as far as the tendency to reduce the efficiency of the ballast is concerned.

It Reduces the Efficiency of the Ballast

By J. D. KEILY

Supervisor, Chesapeake & Ohio, Russell, Ky.

Spraying the roadbed with oil to keep down the dust reduces the efficiency of the ballast. At the best this is only a temporary relief, as eventually there comes a fine oily dust which is much more obnoxious than what might be termed clean dust. The amount of harm the oil does to the efficiency of the ballast is dependent on the kind of ballast. Where the ballast has any content of sand, such as gravel, the oil causes the sand to lose its value as points of friction between the well rounded stone or gravel. This causes the track to work out of line and surface rapidly. The oil will also come to the surface in heavy rains and so coat the roadbed as to prevent a certain amount of the drying out of the roadbed by means of evaporation.

It Depends on the Kind of Ballast

By F. W. HILLMAN

Division Engineer, Chicago & North Western, Chicago

Generally only ballast which is quite full of dirt and fairly compact is oiled. In such cases the oil forms a crust on top which is partially waterproof. It tends to shed water and prevent its percolating into the ballast. The mixing of water with such ballast usually makes it soft and impairs its efficiency. It is axiomatic that the drier the ballast the greater its efficiency. Therefore, it would appear that oiling will increase the efficiency of dirty ballast.

In the case of coarse ballasts, such as crushed stone or slag which have become dirty, oiling will tend to seal up the voids without forming a crust on top. This will prevent percolation of water through the ballast to the sub-grade where it can run off. The water will be retained in the ballast, causing it to become muddy and possibly to heave in winter. It would seem, therefore, that oiling of such ballasts would have a tendency to reduce their efficiency.

The Maintenance of Crossing Plank

What measures should be taken to insure the maintenance of crossing plank in good riding condition for highway traffic?

Sound Timber Should Be Used With Careful Installation

By ROADMASTER

With modern highway traffic conditions plank crossings are often a source of trouble as well as expense but much can be done to render their maintenance less costly by taking proper precautions in their installation. While the first cost of such crossings is comparatively high, a greater expenditure in their construction, which will insure the use of sound material will often prove economical where they must be used. Much of the trouble experienced with these crossings is due to decay of the ties under the crossings, or to decay of the furring strips or of the crossing planks themselves.

In installing a plank crossing for a highway carrying considerable traffic the old ballast should be dug out and thoroughly cleaned or new ballast provided and rail joints should be eliminated from the limits of the crossing, either by the use of long rails or by welding. Provision should be made for draining the ballast under the crossing and all ties should be renewed, preferably with treated ties. The track should then be surfaced, tamping the ties thoroughly to prevent settlement under traffic, after which the planks may be installed. The materials used should be sound timber, which has resistence to decay, if treated material is not available, since it is almost impossible to eliminate moisture under the crossing. A frequent cause of rough crossings is the poor quality of wood used for the furring strips, which decay quickly and furnish uneven support for the planks. Good results have been obtained by using short plank, laid diagonally on the furring and breaking joints. A flangeway of old rail or some other satisfactory material should be used and it has been found desirable in many cases to protect the surface of the plank from abrasion by the use of a mixture of some bituminous compound with sand or stone screenings to form a coating over them.

Interval Between First and Second Lifts for Ballasting Under Traffic

When making a heavy raise in two lifts on stone or gravel ballast under traffic, how closely can the second lift follow the first?

Two Days on Single Track and Three Days on Double Track

By F. S. HALES

Engineer of Track, New York, Chicago & St. Louis, Cleveland, Ohio

Our practice is to allow three days traffic between the first and second lift, although on single track this is often cut to two days in view of the fact that two days traffic on single track is as much as three days on double track and more in some cases. In building new track, we often make the first lift, run a heavy engine with several cars over the track all day and then make the second lift. This, however, does not prove entirely satisfactory as it requires considerable surfacing after the second lift has been made.

Three days traffic on double track and two days traffic on single track, particularly on a railroad carrying a traffic of about 900 cars per day each way should be sufficient.

Depends Upon the Amount of Traffic

By J. D. KEILEY

Supervisor, Chesapeake & Ohio, Russell, Ky.

When making a heavy raise in two lifts on stone or gravel ballast under traffic the time elapsing before the second lift is made should depend on the tonnage that has gone over the track during that interval. Where the track is used frequently and heavy tonnage is hauled the second lift can be made much more quickly than where the traffic is comparatively light. Also consideration must be given as to whether the roadbed is new, settled or unsettled. For example, if a total lift of 12 in. is to be made, the first pull could be made of 9 in. followed by the second lift of 3 in. Where the track handles heavy tonnage the

second lift can be made within from 7 to 10 days, depending on whether the roadbed is settled or unsettled.

Field Tests for Concrete Gravel

Is there any practical way to determine in the field whether gravel from an untested source will be satisfactory for concrete?

Points to be Observed in Making Tests

By C. C. Westfall

Engineer of Bridges, Illinois Central, Chicago

It is entirely practical to determine in the field whether gravel from an untested source will be satisfactory for concrete. Using the specifications of the Joint Committee for Concrete and Reinforced Concrete as a typical specification, the requirement for coarse aggregate specifies that the material shall have clean, hard, strong, durable, uncoated particles free from an injurious amount of soft, friable, elongated, thin or laminated pieces, alkali, organic or other deleterious matter, and shall range in size from fine to coarse within limits to be given in a table. It can probably be assumed that the instances wherein the character of the gravel itself is entirely unsuitable for concrete are rare. Eliminating this, therefore, the determination will depend upon the cleanliness, hardness, shape of the pieces and the gradation.

In general, therefore, a visual examination of the gravel along the following lines will suffice, these points not being given in order of importance, but in the order in which they will probably appeal to one making the examination. (1) Cleanliness, which will include the freedom from earthy materials, either free or as coating on the particles of gravel, which should have been removed by washing and in general, might be considered as applying to anything other than the mineral particles of gravel and sand. (2) Screening. This observation would be to determine whether sufficient sand had been removed from the gravel by screening. (3) Size of material. This will disclose whether or not the gravel is of proper size for the work to be done and whether or not it is properly graded from the large to the small size. (4) Character of gravel. In considering the character of the material, it will be noted whether or not it contains lignite or other unsatisfactory material; whether the gravel is sufficiently hard to use; whether its structure is laminated, and if the pieces are of the proper shape. Examining questionable pieces by scratching with a knife or by breaking them will assist in this inspection.

Methods Suggested for Field Tests

By A. C. Irwin

Manager Railways Bureau, Portland Cement Association, Chicago

There are three points to be considered in testing gravel to be used for concrete: Its durability, its content of deleterious ingredients and its grading. As regards durability, it is obvious that a ready field test is practically out of the question. The only test that has been suggested is the treatment with sodium sulphate. This test is a very severe one and while it will detect shale or shaly limestone, it has not been proven that aggregates passing the test are necessarily durable or that those failing the test will give unsatisfactory results. Generally speaking, gravels have been subjected to a very severe weathering due to the natural process of their formation and the particles surviving this treatment are as durable as any of the natural rocks. Unfortunately, there are just enough exceptions to this rule to make it a little dangerous to follow as a general principle.

With reference to the deleterious ingredients in gravel, the problem is not quite the same as in the case of durability. The colorimetric test for vegetable matter is readily applied and is generally considered effective against unsatisfactory materials of this type. Most of the other ingredients, with the exception of shale pebbles that are rated as undesirable, can be detected by visual inspection. This refers to the thin, laminated or soft particles which are considered objectionable.

As to the matter of grading, the water-cement ratio law gives us a very useful method of testing the desirability of an aggregate. I need not go into detail here other than to say that the test for grading is to determine the amount of materials which can be used with a unit volume of cement and a water-cement ratio selected for the particular type of work. If the resulting mix is a reasonable one such as has been found satisfactory with well known materials, the grading can be considered satisfactory. If, on the other hand, the resulting mix is exceedingly rich, it means an excess of fine material. A gravel deposit deficient in fine material will be detected in the trial mixes by the ready segregation of the cement paste from the aggregate mass. If the deficiency is very pronounced, the water and cement will flow out rapidly from a mass of concrete dumped on the working platform. To remedy this case, additional fine material should be supplied or the water-cement ratio lowered, supplying cement to overcome the deficiency through the medium of a richer mixture.

Type of Pile Driver for Maintenance Work

What are the relative merits of steam hammers and drop hammers for pile drivers on maintenance work?

The Steam Hammer is Preferred

By J. L. Miller

Engineer of Bridges, New York Central, New York

The steam hammer has been found to give better results than the drop hammer in both marine and land driving, since the piles are better driven and, with proper inspection by experienced men, there is no reason why a pile should be either broomed or broken with the use of a steam hammer, no matter how hard (within reason) the material into which the pile is driven. This latter feature is of great economic value in railroad work where the breaking of a pile means a great loss due to the amount of time allotted for driving between trains, especially on a busy railroad. Comparison has been made of the relative speeds of driving by the drop hammers and a ratio of one and one-half times in favor of the steam hammer has been indicated. This will be apparent to one familiar with driving when it is considered that a steam hammer keeps the pile moving whereas the interval between blows of a drop hammer is appreciable at any time and especially so with long piles.

Another feature in favor of the steam hammer is the ability to drive in positions where the leads neces-

sary for a drop hammer could not be placed. In such a position the steam hammer is placed on the pile head and the pile held with guy lines.

In replacing broken piles behind a ferry rack, the pile is placed in position with a derrick, and the steam hammer on the pile and driven. If it becomes necessary to pull a pile, invert the hammer, fasten to the pile and start the hammer as for driving and the pile is drawn out easily. With a drop hammer a great portion of the rack has to be removed to get leads in position to drive. The cost and delay of this preparation and replacing is considerable.

Both types of hammers are used on this road but the drop hammer is gradually being superseded with a steam hammer. The pulling of piles in marine work with a drop hammer outfit entails a great waste of time and is attended with many dangers due to the surging of the driver, and the breaking of lines. In addition, when using a follower with a drop hammer there is great likelihood of the follower getting off the pile, due to the impact.

Depends on Character of Work to be Done

By J. T. Andrews

Assistant Engineer, Batimore & Ohio, Baltimore, Md.

The chief merit of the drop hammer driver is its simplicity, both in maintenance and operation, and the fact that, as a rule, the men using it are better acquainted with this type or can more readily familiarize themselves with it. The steam hammer, on the other hand, is undoubtedly more efficient in hard ground or in quicksand, as the rapidity of its strokes exerts a sustained effort, which forces the pile into the ground with the least injury to it. The steam hammer is also more flexible in its operation and can be used to better effect in close or confined quarters. It is probably more expensive to operate from the standpoint of steam consumption and will usually require a higher capacity boiler than the drop hammer. The question of the respective use of these two types of hammers should be governed entirely by the character of work involved and the kind of material to be penetrated.

Tools for Water Supply Repairmen

To what extent should a railroad provide the tools used by water supply repairmen?

Railroad Should Furnish All Large Tools

By C. R. Knowles

Superintendent Water Service, Illinois Central, Chicago

The railroad should provide all special tools and large tools, such as chain wrenches, sledge hammers, pipe fittings and pipe jointing tools, and in fact all tools used in common by various members of a gang, while the repairman should provide all small hand tools used exclusively by him, such as pipe wrenches up to 12 inches, pliers, hand hammers, speed indicators and such small tools as are ordinarily carried in a hand kit. There is a great deal of loss and abuse in the use of water service department tools, particularly with the smaller hand tools, and it has been proven conclusively that when these tools are the personal property of the water service repairman he will take better care of them than if they belonged to the railroad.

Requiring the water service repairman to furnish small tools of this nature places the responsibility for providing the necessary tools where it belongs, and will tend to more efficient work by eliminating the lack of tools as an excuse for failure to perform the work properly. A good mechanic invariably takes a certain pride in the personal ownership of the tools he uses and the ability of a workman may be judged, to some extent at least, by the quality of the tools he possesses and the manner in which they are cared for.

Only the Large Tools Are Supplied

By I. H. Schram

Regional Engineer, Erie, Chicago

It is our practice to furnish only the larger tools and equipment to the water supply repairmen, these including pipe wrenches, pipe cutters, torches, melting pots and similar equipment, leaving the tools smaller than an 8-in. wrench to be furnished by the repairmen if they desire them.

Repairmen Are Expected to Furnish Small Tools

By Engineer of Water Service

We furnish our repairmen with a canvas or leather tool bag, and supply the large tools such as pipe cutters, pipe chains, large die cutters and other special equipment such as melting pots, block and tackle. We do not furnish small tools as it has been found that these are not as carefully guarded when supplied by the railroad as when they are owned by the repairmen.

A Stimulus for the Safe Handling of Motor Cars

THE recognition of the value of safety in the operation of motor cars is attested in a circular recently issued by E. E. Calvin, vice-president in charge of operation of the Union Pacific System, in which it is announced that a safety emblem will be awarded to each employee to whom a motor car is assigned when the car in his charge has not had an operating accident of any kind during a calendar year, beginning with the year 1926.

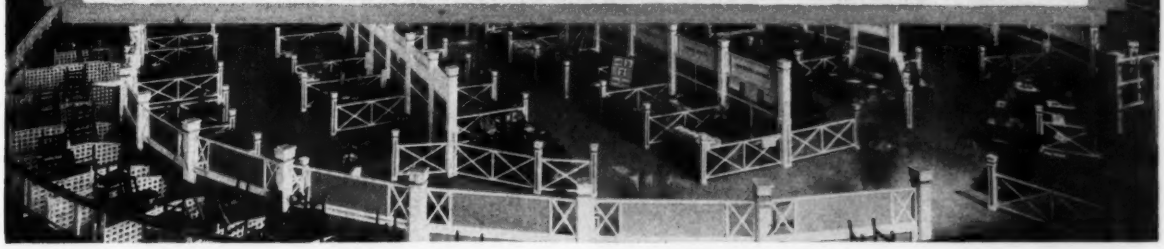
In the award of the emblems an accident resulting in a preventable personal injury or damage to a car will be considered as an operating accident. The rules now in effect in determining personal injuries in connection with the Safety Banner Contest will be followed, while the amount of damage to a car which will be considered as constituting an accident will be left to the judgment of the respective general managers.

The emblem, including a year plate, will belong to the employee to whom it is awarded and will be attached in a conspicuous place to the motor car assigned to him. In case of the transfer of cars the emblem and year plate must be removed and attached to the car re-assigned. After an employee has received an emblem and is entitled to the award in any subsequent year he will be furnished with a year plate for that particular calendar year. As these plates are received from time to time they will be attached to the car in addition to the emblem and plate or plates already thereon.

The announcement closes with the statement that the management solicits the hearty co-operation of all interested employees in carrying out the program and expresses the hope that it will result in a safety emblem and year plates being displayed on each of these cars.

Getting the Manufacturers' Help

Current Developments in New and Improved Labor Saving Appliances



Fairmont Introduces Motor Car Top

JUDGING from the differences of opinion which have been aired from time to time, the desirability of providing motor cars with windshields and tops has long been an open question. It is therefore of interest to note that the demand for such supplementary equipment for motor cars has been sufficient to lead one manufacturer, Fairmont Railway Motors, Inc., to develop a combination windshield and top unit designed for ready application to its model M2 car.

The Motor Car Windshield and Top Tilted to Afford Access to the Power Plant

The frame is constructed entirely of hardwood and the top is covered with a single piece of waterproof canvas. For the windshield, a choice is offered of double-strength glass, plate glass, DuPont pyroxilin or a special safety glass. The windshield is made in two parts in separate frames, each of which may be tilted in or out. Curtains of sufficient length to extend to the floor are supplied for both sides, but the rear is left open. As shown in the illustration, the windshield and top structure are designed for attachment to the seat frame so that it interferes in no way with the tilting of the housing seat for ready accessibility to the power plant.

The Syntron Electric Tie Tamper

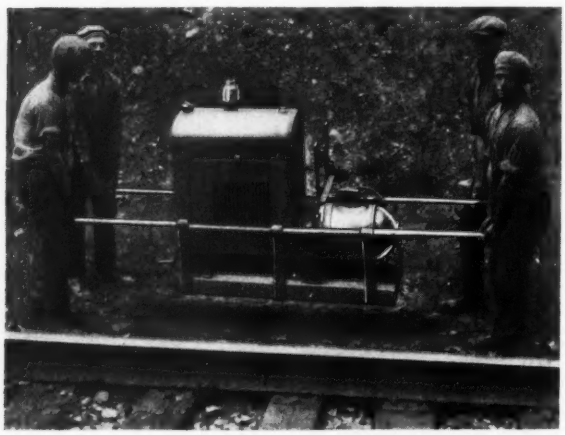
THE Syntron Company, Pittsburgh, Pa., has developed and placed on the market an electric tie tamper of simple design, permitting operation by ordinary track labor, and also a portable direct-connected gas electric power plant for generating current for the tampers as well as for various other electric tools and appliances. The tamper, which has only one moving part, consists of a cylinder fitted with convenient handles for holding it in the proper position, with a tamping bar or tool, the upper end of which is held in a small cylinder, attached to the lower end of the main cylinder. and which is actuated by a reciprocating hardened steel piston moving in bushings in the main cylinder. Powerful field magnets on the inside of the cylinder, one at each end, are energized and de-energized by an alternating current, thus imparting a reciprocating travel to the piston in synchronism with the current.

The Tie Tampers in Operation

The stopping and starting of the tool is controlled by a conveniently located trigger in the lower handle which automatically shuts off the current when the operator's

hand is removed. The alternating current supply is regulated through a small portable control box which has no moving parts and which does not require adjustment. The tamper weighs 56 lb. and delivers 1,200 blows per minute, consuming 1 kw. of electricity. On account of the low voltage and the use of a non-grounded system there is no danger from electric shocks.

The power plant consists of a 4-cylinder, 4-cycle gasoline engine of 15 hp., direct-connected to a 6 k.v.a., 110-volt, a.c. generator. The unit is mounted on wooden skids and is provided with handles for lifting. Flanged rollers, mounted between the skids at a level which does not interfere with the setting of the unit, permit its being placed on one rail of the track and moved to another location with little effort. The engine is enclosed in a removable sheet metal housing which protects it from the weather or from tampering, while the generator is protected by a fly wheel housing.



The Portable Power Plant

These tampers have been in service on the Pennsylvania, the Northern Pacific, the Pittsburgh & West Virginia and the Monongahela. Tests conducted on the latter road on track ballasted with crushed hard slag showed costs ranging from 2.5 to 4.6 cents per tie with the electric tampers, as compared with from 8.75 to 10 cents per tie for hand labor. A gang of six men was used with the electric tampers against 15 men in the gang tamping by hand.

A New Machine for Cleaning Ballast

THE RAILWAY Maintenance Corporation, Pittsburgh, Pa., has placed on the market a gasoline-operated, self-propelled machine of a distinctly new type for cleaning ballast in the space between the ends of the ties on multiple track railroads which is said to excavate and clean the ballast to a depth of 16 in. below the top of the ties, with tracks at 13 ft. centers, at the rate of 150 lin. ft. per hour, without interfering with traffic, and at a cost of from 5½ to 6 cents per lin. ft., under ordinary conditions, including labor, fuel, repairs, depreciation and interest on investment.

This machine, which from its method of operation is known as the "McWilliams Mole," consists of a steel frame, narrow enough to clear the ends of the ties for all ordinary spacings of main tracks, which carries on its forward end two cutting discs set at an inclination from the horizontal. In operation these discs revolve and as their shafts are set eccentrically they subject the loosened material to a churning action which has a tendency to separate the dirt from the ballast and permits the use of a screen with a comparatively small mesh. From the discs the ballast falls on an endless belt conveyor which carries it over the engine, located in the center portion of the frame, and thence to a reciprocating screen which agitates the material passing over it, thus further facilitating the separation of the dirt from the ballast. As the dirt goes through the screen it falls on an endless belt conveyor which delivers it to sheet metal boxes attached to the rear of the

Front View of the Machine in Operation

machine, while the cleaned ballast is delivered to the intertrack space.

The machine is self-propelling, traction being obtained by chain treads running on the ties near their outer ends, the treads spanning four or five ties. The shafts carrying the treads have a cam arrangement which permits adjustment for tracks at different levels and allows the machine to set level where the difference in elevation amounts to as much as eight inches. The machine is kept in its proper position between the tracks by angle irons laid parallel to the rails and separated from them by wooden spacing blocks. The ends of the shafts which carry the chain treads are equipped with rollers which reduce friction as the machine is guided by the angle irons. The power plant consists of a specially designed Le Roi 4-cylinder, 15-hp. motor with built-in magneto and governor. After starting, its operation is automatic as it has neither throttle nor spark lever.

The design of the machine and the materials used in its construction are based upon the hard service it may be expected to encounter and to allow it to be operated by a section foreman.

The machine is started in a hole dug in the ballast between the tracks and the usual crew consists of a foreman and six laborers, four of the latter being required to carry the dirt boxes from the machine, and two to move up the angle irons, level off the ballast back of the machine and dig out the cribs between the ends of the ties ahead of the machine when necessary.

One of these machines has been in operation on the Pennsylvania near Pittsburgh for the last four months, cleaning ballast between tracks with centers varying from 12 ft. 4 in. to 13 ft. 6 in. with curvature up to 3 deg. and where the elevation of adjacent tracks varied from level to a difference of 8 in. Some of the ballast cleaned contained dirt to the extent of

Rear View of the Machine, Showing Cleaned Ballast

40 per cent of its volume, consisting in some cases of loose coal and ashes and in others of caked mud from churning joints. When the ballast is very wet and muddy it is necessary to cut down the speed of the machine, due to the clogging action of the mud on the rear belt.

Additional machines are now being completed for both the Pennsylvania and the New York Central. In these machines the chain tread is replaced by toothed wheels riding on the leg of the angle iron which is punched to form a rack, thus furnishing more positive traction than is supplied by the chain tread.

The Material Market

THE outstanding development in the iron and steel market during the last month has been the placing of liberal orders for rails for 1927 requirements by a number of the larger roads, the magnitude of which indicates that rail purchases for the next year will equal, if not exceed, those of recent years. Among the orders placed during the last 30 days are those of the New York Central for 227,675 tons, the Pennsylvania for 160,000 tons with an option on 40,000 tons additional, the Atchison, Topeka & Santa Fe for 144,860 tons, the Louisville & Nashville for 67,000 tons and the Illinois Central for 66,000 tons. That orders for track fastenings will be placed in proportionate volume is evident from inquiries for tie plates, joints, bolts and spikes already on the market.

This is the season of the year when railroad buying is always an important factor in the iron and steel market and the influence of railway purchases is particularly marked this year because of what is at least a temporary lull in the demand for iron and steel from other quarters. However, as yet there is no indication that this aspect of the market will have any definite influence on prices for, as shown in the table below, October prices differ little from those for September.

PRICES PER 100 LB.

	September		October	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	$2.80 to $2.90	$2.90	$2.80 to $2.90	$2.90
Track bolts	3.90 to 4.25	3.90	3.90 to 4.25	3.90
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.25 to 2.35	2.35	2.25 to 2.35	2.35
Boat spikes	3.25	3.25	3.25	3.25
Plain wire	2.50	2.55	2.50	2.55
Wire nails, keg	2.65	2.70	2.65	3.70
Barb wire, galv.	3.35	3.40	3.35	3.40
C. I. pipe, 6 in. 12 in., ton	47.20 to	49.20	47.20 to	48.70
Plates	1.90	2.10	1.90	2.10
Shapes	2.00 to 2.10	2.10	2.00 to 2.10	2.10
Bars, soft steel	2.00 to 2.10	2.10	2.00 to 2.10	2.10
Rivets, struc.	2.50 to 2.60	2.70	2.45 to 2.60	2.60 to 2.75
Conc. bars, billet	2.00 to 2.10		2.00 to 2.10	
Conc. bars, rail	1.80 to 1.90	2.00	1.80 to 1.90	2.00
Rails, per gross ton, f.o.b., mills		43.00		43.00

The scrap market, which is always much more sensitive to market conditions than that for new materials, is decidedly weak and the prices quoted below are definitely lower than those for the month of September.

PER GROSS TON

	September	October
Relaying rails	$26.00 to $31.00	$26.00 to $31.00
Rails for rerolling	17.50 to 18.00	16.50 to 17.00
Rails less than 3 ft. long	17.50 to 18.00	16.50 to 17.00
Frogs and Switches cut apart	16.00 to 16.50	14.75 to 15.25
Steel angle bars	16.25 to 16.75	15.00 to 15.50

The reduction in the demand for lumber has not as yet caused any marked deviation in prices from those which have prevailed for considerable periods.

SOUTHERN PINE MILL PRICES

	September	October
Flooring, 1x4, B and B flat	$44.39	$45.83
Boards, 1x8, No. 1	37.90	38.82
Dimension, 2x4, 16, No. 1, common	28.45	28.52
Dimension, 2x10, No. 1, common	29.94	31.70
Timbers, 4x4 to 8x8, No. 1	29.24	28.72
Timbers, 3x12 to 12x12, rough	43.67	42.82

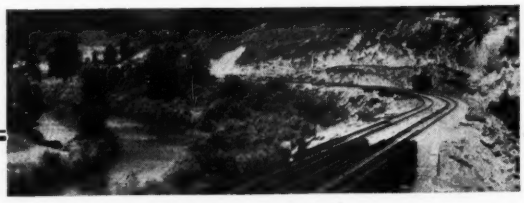
DOUGLAS FIR MILL PRICES

Flooring, 1x4, No. 2, clear, flat	$27.00	$27.00
Boards, 1x8, 6 to 20, No. 1, common	16.00	16.00
Dimension, 2x4, No. 1, common	17.00	17.00
Dimension, 2x10, 16, No. 1, common	17.00	17.00
Timbers, 6x6 to 8x8, No. 1	20.00	20.00
Timbers, 3x12 to 12x12, rough	18.00	18.00

Prices for Portland cement per barrel in carload lots not including package, as given in the table below, are without change from those reported last month.

New York	$2.15	Minneapolis	$2.32
Pittsburgh	2.09	Denver	2.85
New Orleans	2.30	Dallas	2.05
Chicago	2.10	San Francisco	2.31
Cincinnati	2.37	Montreal	1.15

Railway News Briefly Told



The Kentucky Court of Appeals holds that a railroad is not liable for injuries to a trackman while using tie tongs, the points of which are not sharp enough to grip the ties safely, such tongs being simple tools the employer is not required to inspect and the risk of using which the employee assumes.

The unprecedented freight car loadings of the present year has led the American Railway Association to issue a circular letter appealing to the shippers and receivers of freight to give especial attention to the prompt loading and unloading of cars during October and November to avert the dangers of a car shortage.

The Chicago & North Western has named its bridge over the Des Moines river between Boone and Ogden the Kate Shelly, as a memorial to the 15-year-old girl who risked her life in 1881 by crossing the old bridge in the face of a violent storm to warn an approaching train that the structure was about to be carried away. This act won her national fame and when she died in 1912 a special train carried mourners to her funeral.

The Circuit court at Jefferson City, Mo., has upheld the action of the Missouri Public Service Commission in refusing to grant a certificate of convenience and necessity to the St. Louis-Kansas City Short Line for the construction of an electric line between St. Louis and Kansas City, about 290 miles long. The promoters have filed an appeal with the Missouri Supreme court.

The special train of seven cars carrying the Cardinal baseball club from St. Louis to New York, over the Pennsylvania on October 7 and 8, covered the 1,052 miles between the two cities in 21 hours 22 minutes, averaging 49.27 miles an hour and constituting the second fastest run over this route in the history of the road, the best run, 20 hours 28 minutes, having been made on November 16, 1925, with a train of six cars.

An agreement has been reached between the city of Chicago and the railroads interested which will permit straightening the Chicago river between Polk and Sixteenth streets. As a result of this agreement approximately $9,000,000 worth of real estate will change hands and extensive track changes will be necessary. The improvement will permit opening three streets southward from the loop district and will also facilitate the planning of a proposed passenger terminal station.

The New York, New Haven & Hartford celebrated the centenary of the Granite Railway, three miles long, which was built in 1826 and opened for traffic on October 8 of that year for the purpose of transporting granite for the construction of Bunker Hill monument from the quarry to tidewater in Neponset river. The rails of the road as originally built were of wood and the motive power consisted of horses. The greater portion of the original right of way is now used by the Granite branch of the New Haven.

Revenue freight car loadings for the week ended October 16 totaled 1,210,163 cars, breaking all previous records and exceeding by 23,152 cars the former high record established in the week ended September 18. It is also an increase of 25,301 over the previous week, and of 104,154 over the corresponding week in 1925. The cumulative total for the first 42 weeks of the present year is 42,832,438, or an average of more than a million cars per week, compared with 41,218,272 for the corresponding period in 1925.

Railroad property was damaged and service was interrupted by floods in central and western Illinois on October 2 to 5, inclusive, for the second time within a month. The Chicago & North Western suspended operation from Peoria to Benld, due to the washing out of a portion of its bridge over Salt creek. Three bridges on the Wabash, between Hannibal, Mo., and Decatur, Ill., were washed out or so undermined as to necessitate complete rebuilding and about 400 ft. of track was washed out at Naples. This road also suffered temporary delays by water over its tracks at Monticello and Riverton and by minor washouts north of Decatur. Trains on the Chicago & Alton were temporarily delayed by water over its tracks at Hillview on October 3, and at Mason City on October 5. High water in the Illinois river caused considerable damage to the Chicago, Burlington & Quincy at Beardstown, where the river later reached a stage higher than any previous record.

Farmers and business men aided in the financing of an extension of a branch line of the Great Northern in Montana by purchasing, at par value, $325,000 worth of stock. The line, which extends from Scobey to Opheim, a distance of 50 miles, was constructed at a cost of $1,250,000 and made possible a saving of more than $500,000 in the transportation of over 2,000,000 bu. of grain of this year's harvest. The rich agricultural region served by the new line embraces nearly 2,000 sq. mi. of tillable land which formerly was from 30 to 55 miles from the nearest railroad. Due to the superior grade of the wheat raised in this region, it commands a premium of from 8 to 50 cents a bushel on the Minneapolis market, thus making it a profitable crop even with the long team or tractor haul necessary before the railroad was built. The 20 miles of the new line from Scobey to Peerless, laid in 1925, consisted of 60-ft. panels of track taken up intact from two abandoned lines on the Mesabi division in Minnesota, the panels being loaded on flat cars, transported to Montana and swung into place on the new grade by locomotive cranes.

The Norfolk & Western held its seventh annual efficiency meeting at Richmond, Va., on October 8 and 9 with an attendance of about 350 delegates. The delegates to these meetings are selected by local better service clubs formed by the employees on their own initiative to discuss means of improving efficiency and service and the purpose of the annual meetings is not only to encourage recommendations for such improvements but also to bring the officers, supervisors, and men into intimate contact, thus making for a better understanding and the building up of a strong family spirit. The committee on roadway and grounds reported that railway injuries are one of the most serious problems and that to improve conditions in this respect special attention should be directed to (1) Interest the division officer in charge of roadway work; (2) actively interest the roadmasters and foremen; (3) the proper instruction of new men in safe methods of work; (4) close personal supervision of dangerous work; (5) the condition of track tools; and (6) safe motor car operation. It also emphasized the importance of keeping highway crossings in good condition.

Personal Mention

General

C. S. Churchill, vice-president in charge of purchases, real estate and valuation of the Norfolk & Western, has retired after a long period of service with that company, having reached the age limit, and will engage in the general practice of engineering in Roanoke, Va. Mr. Churchill was born on September 22, 1856, at New Britain, Conn., and graduated from the Sheffield Scientific School of Yale University in 1878. He entered railway service in 1879 as a transitman on surveys for what was known as the "Parallel Railroad," which contemplated paralleling the tracks of the New York, New Haven & Hartford between New York and Providence, R. I. From September, 1880, to July, 1881, he was engaged on the construction of the Meadville & Linesville (now a part of the Bessemer & Lake Erie) and from July, 1881, to January, 1884, he was division engineer on location and construction on the Pittsburgh, McKeesport & Youghiogheny (now a part of the Pittsburgh & Lake Erie). On January, 1, 1884, he was appointed principal assistant engineer on the location and construction of the Schuylkill Valley line of the Pennsylvania between Hamburg, Pa., Pottsville and Wilkesbarre, and in May, 1887, he was appointed engineer maintenance of way of the Shenandoah Valley (now a part of the Norfolk & Western). In May, 1888, he was appointed engineer in charge of the Ohio extension of the Norfolk & Western and on October 1, 1888, he was made engineer maintenance of the same road, continuing in that position until January 1, 1903, when he was promoted to chief engineer of the Norfolk & Western, with headquarters at Roanoke, Va. He was promoted to assistant to the president on March 1, 1914, and placed in charge of federal valuation matters, in which capacity he served until October 1, 1918, when he was promoted to corporate vice-president. At the termination of federal control he was made vice-president in charge of purchases, real estate and valuation, serving in that capacity until his recent retirement.

C. S. Churchill

H. M. Hull, chief engineer of the Texas and Louisiana lines of the Southern Pacific, with headuarters at Houston, Tex., has been promoted to the newly created position of assistant to the president, with the same headquarters. Mr. Lull was born on March 31, 1875, at Windsor, Vt., and was educated at Dartmouth College. He entered railway service as a draftsman on the Southern Pacific in 1906 and in the following year was promoted to assistant engineer on maintenance and construction in California and Oregon. He was promoted to assistant division engineer of the Portland division, with headquarters at Portland, Ore., in 1915, and to division engineer of the same division in 1918. In 1920 he was promoted to chief engineer of the Texas and Louisiana lines, with headquarters at Houston, Tex., which position he was holding at the time of his recent promotion to assistant to the president.

G. D. Brooke, assistant to the vice-president in charge of operation of the Chesapeake & Ohio, with headquarters at Richmond, Va., and an engineer by training and experience, has been promoted to general manager and **L. B. Allen**, superintendent maintenance of way, with the same headquarters, has been promoted to succeed Mr. Brooke.

Mr. Brooke was born on September 15, 1878, at Sutherlin, Va., and was graduated from the Virginia Military Institute in 1900. He entered railway service on July 17, 1902, as a rodman on the Baltimore & Ohio and was promoted successively to levelman, transitman and assistant engineer in charge of field work and location surveys. He was promoted to assistant division engineer, with headquarters at Pittsburgh, Pa., in 1908 and to division engineer with headquarters at Baltimore, Md., in July, 1909, in which position he remained until March, 1911, when he was made assistant engineer in the operating department. He was promoted to assistant superintendent, with headquarters at Keyser, W. Va., in February, 1912, and to superintendent in September of the same year, serving in this capacity on various divisions until May, 1918, when he was appointed special representative of the transportation department, with headquarters at Baltimore, Md. In July, 1918, he was appointed supervisor in the operating division of the United States Railroad Administration, with headquarters at Philadelphia, remaining in that positon until March, 1919, when he returned to the Baltimore & Ohio as superintendent of transportation, with headquarters at Cincinnati, Ohio. On August 1, 1924, he was appointed assistant to the vice-president in charge of operation of the Chesapeake & Ohio, and was holding that position at the time of his recent promotion to general manager.

G. D. Brooke

Mr. Allen was born on April 19, 1879, at Lexington, Ky., and graduated from the Kentucky State University in 1899. He entered railway service as a rodman on the Southern and from August, 1899, to January 1, 1904, he was engaged on location and construction on the Chesapeake & Ohio, being promoted to assistant in the office of the engineer maintenance of way on the latter date. On January 1, 1905, he was promoted to division engineer of the Kentucky division, with headquarters at Ashland, Ky., remaining in that position until May 1, 1910, when he was promoted to engineer maintenance of way of the Kentucky general division and the Chesapeake & Ohio of Indiana, with headquarters at Covington, Ky. From this position he was promoted to assistant chief engineer, with headquarters at Richmond, Va., on January 1, 1914. On February 1 of the same year he was made superintendent of the Huntington and Big Sandy divisions, with headquarters at

L. B. Allen

Huntington, W. Va., and on July 1, 1916, he was promoted to general superintendent of the Western General division, from which position he was promoted to superintendent maintenance of way of the system, which position he was holding at the time of his recent promotion to assistant to the vice-president.

J. A. Rogers, division engineer on the Canadian National, with headquarters at Saskatoon, Sask., has been promoted to assistant superintendent of the Saskatoon division, with the same headquarters.

G. R. L. French, who has been promoted to vice-president of the Rutland in addition to his duties as general manager, is an engineer by training and experience. He was born on May 18, 1863, at Salisbury, Mass., and graduated from the Massachusetts Institute of Technology in 1884. He entered railway service in September of the same year on the Chicago, Burlington & Quincy at Lincoln, Neb., and held various positions in the engineering and operating departments until 1890, when he was appointed roadmaster of the Southern and Eastern divisions of the Boston & Maine, subsequently serving as assistant superintendent of the Connecticut River division and superintendent of the Boston Terminal division of the same road. He was made general superintendent of the Rutland, with headquarters at Rutland, Vt., on May 1, 1912, and was promoted to acting general manager in January, 1923, this being followed by his appointment as general manager in November, 1924, in which capacity he was serving at the time of his promotion to vice-president.

L. G. Morphy, chief engineer of the Rutland, with headquarters at Rutland, Vt., has been appointed also general superintendent, with the same headquarters. Mr. Morphy was born on December 4, 1876, at Orizaba, Vera Cruz, Mexico, and was educated at Spring Hill College at Mobile, Ala., and at Rennsalaer Polytechnic Institute. He entered railway service in 1900, on the New York Central and the following year was promoted to assistant supervisor of track. In 1902 he was promoted to acting supervisor of track and later to assistant engineer maintenance of way. In 1903 he was promoted to assistant engineer of construction and design and in 1904 to assistant engineer of grade crossing elimination. In 1905 he was made resident engineer for the Western district and from 1905 to 1907 was assistant to the principal assistant engineer. In 1907 he became assistant engineer on maintenance of way and construction on the Boston & Albany and in 1908 was promoted to assistant to the chief engineer. In 1910 he was promoted to designing engineer, serving in this capacity until 1919, when he was promoted to principal assistant engineer. During 1920 he was special representative and manager in South America and Mexico for the Foundation Company, New York. He returned to railway service in 1921 as chief engineer of the Rutland, which position he still holds in addition to his new position as general superintendent.

Engineering

G. P. Williams, assistant engineer maintenance of way on the Long Island, with headquarters at Jamaica, N. Y., has been promoted to engineer maintenance of way, succeeding **E. M. Weaver,** who has retired.

G. W. Curtiss, assistant division engineer on the New York, New Haven & Hartford, with headquarters at New Haven, Conn., has been promoted to division engineer of the Danbury and C. N. E. divisions, with headquarters at Danbury, Conn., succeeding **C. D. Perkins,** whose death is noted elsewhere in this issue. **C. E. Carlson,** track supervisor, with headquarters at Putnam, Conn., has been promoted to assistant division engineer, with headquarters at New Haven, Conn., to succeed Mr. Curtiss.

H. J. Bogardus, whose promotion to division engineer of the Pt. Huron-Grand Rapids division of the Pere Marquette, with headquarters at Saginaw, Mich., was noted in the October issue, was born on September 23, 1892, at Grand Rapids, Mich., and was educated at the University of Michigan. He entered railway service in 1916 as a transitman on the Pere Marquette and was promoted to assistant division engineer of the Chicago-Petoskey division in 1919, which position he was holding at the time of his recent promotion to division engineer.

E. H. Roth, whose promotion to assistant engineer on the Norfolk & Western, with headquarters at Norfolk, Va., was noted in the September issue, was a special engineering draftsman for the Canadian Pacific from July, 1912, to January, 1913. He entered the service of the Norfolk & Western on January 25, 1913, as an engineering draftsman in the chief engineer's office at Roanoke, Va., and on September 1, 1916, was promoted to crossing engineer, with the same headquarters, which position he held at the time of his recent promotion to assistant engineer in charge of maintenance and construction from Phoebe, Va., to and including the Norfolk terminals.

C. J. Geyer, assistant superintendent maintenance of way of the Chesapeake & Ohio, with headquarters at Richmond, Va., has been promoted to the newly created office of engineer maintenance of way, with the same headquarters and the office of superintendent maintenance of way, which was held by **L. B. Allen,** until his promotion to assistant to the vice-president in charge of operation, as noted elsewhere in this issue, has been abolished. Mr. Geyer was born on April 6, 1889, at Zanesville, Ohio, and entered railway service in May, 1908, in the construction department of the Grand Trunk Pacific, leaving that road in 1909 to enter the service of the Chesapeake & Ohio as a rodman. He was later promoted to instrumentman and served in that capacity until 1913, when he was promoted to assistant engineer on the Huntington division. In 1918 he was promoted to division engineer, with headquarters at Richmond, Va., and in 1924 he was promoted to assistant superintendent maintenance of way, with the same headquarters, which position he was holding at the time of recent promotion to engineer maintenance of way.

L. M. Bates, whose promotion to division engineer on the Chicago & North Western, with headquarters at South Pekin, Ill., was noted in the September issue, was born on August 13, 1882, at Chicago, and was educated at Armour Institute of Technology, later taking a special course at the University of Wisconsin. He began engineering work as a rodman for the Witherspoon-Englar Company on concrete coal dock construction at South Chicago and Milwaukee, Wis., and later served in the same capacity with the United States Steel Corporation at Gary, Ind., on dock work, building construction and track layouts. He entered railway service with the Chicago & North Western and was later with the Chicago & Western Indiana on the revision of Clearing yard, returning to the North Western as an instrumentman on grade revision work in southern Illinois, and later served in the same capacity on the Minnesota, Ashland and Wisconsin divisions. From this he was promoted to assistant engineer with the auditor of capital expenditures and was later transferred to the Galena division, with headquarters at Chicago, which position he was holding at the time of his recent promotion to division engineer.

R. W. Barnes, construction engineer on the Texas and Louisiana lines of the Southern Pacific, with headquarters at Houston, Tex., has been promoted to chief engineer, with the same headquarters, to succeed **H. M. Lull,** whose promotion to assistant to the president is noted elsewhere in this issue. **E. A. Craft,** assistant to the chief engineer, with headquarters at Houston, has been promoted to the newly created position of engineer of maintenance of way, with the same headquarters.

Mr. Craft was born on September 11, 1893, at Danville, Ill., and entered railway service in October, 1909, as chainman on the Chicago & Eastern Illinois and later was promoted to transitman, serving successively in this capacity at Evansville, Ind., Salem, Ill., and Danville, until June, 1917, when he was commissioned first lieutenant in the Engineers' Officers Reserve Corps assigned with the 17th Engineers (Railway) at St. Nazaire, France. He was transferred to the Transportation Corps

on November 1, 1917, and from January 1, 1918, to August, 1919, was superintendent in the army transport service, receiving a commission as captain in October, 1918, and as major in February, 1919. He returned to the Chicago & Eastern Illinois as assistant division engineer at Danville in October, 1919, and remained in that position until January, 1920, when he was appointed assistant superintendent of the El Paso division of the Southern Pacific, with headquarters at El Paso, Tex. In May, 1920, he was promoted to assistant to the chief engineer, with headquarters at Houston, Tex., which position he was holding at the time of his recent promotion to engineer of maintenance of way.

W. A. Bercaw, roadmaster on the Hannibal division of the Chicago, Burlington & Quincy, with headquarters at Cameron, Mo., has been promoted to district engineer maintenance of way, with headquarters at St. Louis, Mo., to succeed **Arthur Craine**, who has resigned to become a representative at St. Louis of the American Hoist & Derrick Company, St. Paul, Minn.

P. Petri, division engineer on the Baltimore & Ohio, with headquarters at Cumberland, Md., has been promoted to engineer maintenance of way, with headquarters at Baltimore, Md., succeeding **E. G. Lane**, who has been assigned to other duties. **C. E. Newhouse** has been appointed division engineer, with headquarters at Weston, W. Va., to succeed **G. B. Farlow**, who has been transferred to Grafton, W. Va., to replace **J. L. Maher**, who in turn has been transferred to Connellsville, Pa., where he will succeed **A. R. Carver**, who has been transferred to Cumberland to replace Mr. Petri.

Track

J. C. Jones has been appointed roadmaster on the Cut-Knife subdivision of the Saskatchewan district of the Canadian Pacific.

A. L. Campbell has been appointed roadmaster of the Dunsmuir district of the Southern Pacific, with headquarters at Dunsmuir, Cal.

A. T. Darnell, roadmaster on the Gulf, Colorado & Santa Fe, with headquarters at Cleburne, Tex., has been appointed general track inspector, a newly created position, with headquarters at Galveston, Tex.

L. V. Lienhard has been appointed acting roadmaster of the First and Canon City districts of the Colorado division of the Atchison, Topeka & Santa Fe, to succeed **T. A. Blair**, who has been assigned temporarily to other duties.

C. V. Frisch, general track foreman on the Pennsylvania, has been promoted to track supervisor, with headquarters at Carrothers, Ohio, where he succeeds **W. F. Renz**, who has been transferred to Detroit, Mich., to replace **L. H. Brenaman**, who has resigned.

E. J. Brown, assistant roadmaster on the Aurora division of the Chicago, Burlington & Quincy, with headquarters at Aurora, has been promoted to roadmaster on the Chicago division, with headquarters at Chicago, to succeed **R. L. Sims**, who has been transferred to Cameron, Mo., to replace **W. A. Bercaw**, whose promotion to district engineer maintenance of way, with headquarters at St. Louis, Mo., is noted elsewhere in this issue.

C. P. Richmond has been appointed track supervisor on the Old Colony division of the New York, New Haven & Hartford, with headquarters at Framingham, Mass., to succeed **A. A. Cross**, who has been transferred to the New London division, with headquarters at Putnam, Conn., where he replaces **E. O. Carlson**, whose promotion to assistant division engineer, with headquarters at New Haven, Conn., is noted elsewhere in this issue.

R. S. Reed, district roadmaster on the Central division of the Union Pacific, with headquarters at Maryville, Kan., has been promoted to general roadmaster of the same division, with the same headquarters, to succeed **B. H. Moon**, who is on sick leave, and **Arthur Jung** has been appointed district roadmaster to succeed Mr. Reed. **W. B. Bret**, section and extra gang foreman, has been promoted to district roadmaster on the Colorado division, with headquarters at Colby, Kan., to succeed **J. E. Swanson**, who has been transferred to the Wyoming division, with headquarters at Sidney, Neb., where he replaces **R. A. Walker**, who has been assigned to other duties.

W. B. Marshall, whose promotion to roadmaster on the newly created roadmaster's district on the Cincinnati, New Orleans & Texas Pacific lines of the Southern was noted in the September issue, entered railway service on September 12, 1913, as a student apprentice on the Southern at Monroe, Va., and was promoted to assistant track supervisor, with headquarters at Strausburg, Va., on March, 1915. He was promoted to track supervisor on the Danville division in January, 1916, and to acting roadmaster, with headquarters at Norfolk, Va., on May 1, 1926, in which capacity he was serving at the time of his recent promotion to roadmaster.

Purchasing and Stores

J. D. Dunlap has been appointed stationer of the Missouri-Kansas-Texas, with headquarters at St. Louis, Mo., succeeding **F. E. Robinson.**

F. I. Plechner, assistant purchasing agent on the Great Northern, with headquarters at St. Paul, Minn., has been promoted to purchasing agent, with the same headquarters, succeeding **F. A. Bushnell**, resigned.

E. C. Van Valkenburg has been appointed purchasing agent and general storekeeper of the Oklahoma-Southwestern, with headquarters at Tulsa, Okla., taking over duties previously performed by **R. V. Miller**, general manager of the company.

Edwin J. Myers, assistant general storekeeper of the Northern Pacific, with headquarters at St. Paul, Minn., has been promoted to general storekeeper to succeed **C. C. Kyle**, whose promotion to purchasing agent, with the same headquarters, was reported in the October issue. **H. M. Smith**, traveling storekeeper, with headquarters at St. Paul, has been promoted to assistant general storekeeper to replace Mr. Myers and will be succeeded by **C. A. Nichols**, district storekeeper, with the same headquarters. **W. O. Weber**, has been appointed division storekeeper, with headquarters at Dilworth, Minn., to replace **A. C. Johnson**, who has been promoted to succeed Mr. Nichols.

Obituary

Desmond Fitzgerald, consulting engineer, died at his home in Brookline, Mass., at the age of 80. In his earlier years he was engaged in railroad service and advanced from the position of axeman on the Indianapolis & Vincennes in 1867 to chief engineer of the Boston & Albany in 1871, in which position he remained until 1873, when he entered the service of the Boston water works.

J. E. Johnson, notice of whose death appeared in the October issue, was born on August 25, 1883, at Tipton, Ind., and was educated at Ohio State University. He was appointed division engineer on the Hocking Valley, with headquarters at Logan, Ohio, at the age of 22 and remained in that position for five years. He was afterwards connected with the Baltimore & Ohio and the Michigan Central and since 1912 to the time of his death was division engineer on the Pere Marquette.

Clifford D. Perkins, division engineer of the New York, New Haven & Hartford and the Central New England, with headquarters at Danbury, Conn., died on September 24 at his home in Stamford, Conn., at the age of 66. Mr. Perkins was born at Northampton, Mass., and was a graduate of Yale University. He had been connected with the New Haven for 42 years, and was for 22 years roadmaster on the New York division, with headquarters at Stamford, and later at Harlem river. From this position he was promoted to assistant engineer maintenance of way and in 1921 was appointed division engineer, which position he was holding at the time of his death.

Construction News

The Atchison, Topeka & Santa Fe has awarded a contract to Robert E. McKee, El Paso, Tex., for the construction of a one-story steam-operated powerhouse at Bakersfield, Cal., estimated to cost $65,000. A contract has been awarded to the Sharp & Fellows Construction Company for grading in connection with the double tracking of 22 miles of line east and west of Amarillo, Tex., from St. Francis to Haney. Tie and rail laying will be done by company forces which will also construct additional yard facilities of Amarillo, Tex., including about 10 miles of new tracks. Plans are being prepared for the construction of an engine terminal at Emporia, Kan., including a 50-stall enginehouse, an apprentice school building, a 1,000-ton coaling station with 1,500-cu. yd. sand bins, cinder conveyors, oil and water lines and a power house. Bids have been closed for the construction of two 20-ft. by 400-ft. poultry sheds at Chicago.

The Chesapeake & Hocking, a subsidiary of the Chesapeake & Ohio, has been authorized by the Interstate Commerce Commission to build a new line from a connection with the C. & O. at or near Gregg, Ohio, to a connection with the Hocking Valley at Valley Crossing, Ohio, a distance of about 63 miles. The C. & O. now operates between these points via the Norfolk & Western under a trackage agreement which the latter company has proposed to terminate on September 16, 1927. More than 63 per cent of the revenue coal tonnage of the C. & O. moves via Cincinnati, Ohio, and Columbus, and the application states that provision must be made to handle 25,000,000 tons a year through Columbus in the next five years. The new line will be double-tracked and laid with 100 lb. rail. The maximum grades will be 0.2 per cent northbound and 0.5 per cent southbound, while the maximum curvature will be 3 deg. Construction is expected to begin immediately and to be completed in about a year.

The Chicago & North Western has prepared plans for the installation of a direct steaming smoke elimination system at the roundhouse at Chicago avenue and Halsted street, Chicago, and a contract for the installation of the steaming plant has been let to the Ogle Construction Company, Chicago. Including the construction of a storage building at the Crawford avenue shops and other changes incident to the installation, the total cost of the project is estimated at approximately $175,000. A contract has been awarded to the Ellington-Miller Company, Chicago, for the construction of six frame storage buildings for the car department at the Proviso, Ill., yard, estimated to cost $40,000, and for a three-story office building at the same place to house the yard organization. A contract has been awarded to James Stewart & Co., Chicago, for the construction of a 400,000-bu. reinforced concrete grain elevator at Green Bay, Wis., at an estimated cost of $200,000. The elevator, which replaces one destroyed by fire, will be made up of ten circular storage bins. A contract has been awarded to S. G. Cool, Chicago, for a three-stall addition to the roundhouse at Benld, Ill.

The Chicago, Milwaukee & St. Paul has been authorized by the federal court of Northern Illinois to expend $3,571,000 for the construction of 2,700 ft. of track elevation and 2,300 ft. of track depression in Milwaukee, Wis. This order obligates this company to comply with an order of the Railroad Commission of Wisconsin issued in 1915. A contract for the construction of a one-story tile and stucco combined freight and passenger station at Waukon, Iowa, estimated to cost $15,000 has been let to J. C. Jacobsen, Waukon. Authority was also given to expend $575,000 for improvement and maintenance, including $56,000 for new trackage at Belt Junction, Ind., additional yard tracks at Cedar Rapids, Ia., interchange track at Davenport, Ia., extension of passing track at Newtown, Mo.; $70,000 for bridge and concrete culvert work at Madrid, Ia., Albany, Ill., Bovill, Idaho, and Denton, Mo., and $449,000 for an extension to the freight station at Aberdeen, S. D., and for maintenance work.

The Chicago, Rock Island & Pacific has awarded a contract for the construction of a reinforced concrete viaduct over College street, Iowa City, Iowa, to A. A. Alexander, Iowa City. The cost, $36,900, will be borne jointly by the railroad and the city. A contract has been awarded to the Bates & Rogers Construction Company, Chicago, for the construction of several pile bridges on the Ponca City line at Tonkawa, Okla., at a cost of about $25,000. Bids were received until October 19, for track elevation near Ninety-fifth street at Jeffery and Paxton avenues, Chicago. Construction of this project is estimated to involve an expenditure of $200,000.

The Delaware, Lackawanna & Western has entered into an agreement with the City of Paterson, N. J., under which it will eliminate grade crossings, build a new passenger station and four-track its line through that municipality. The total cost of the work is estimated at $1,000,000, in which the city will share. This company and its subsidiary, the Morris & Essex, have been authorized by the Interstate Commerce Commission to construct 0.68 miles of 4-track line in Jersey City, N. J., in connection with a new freight terminal to be built there. It is planned to utilize motor trucks in the under-Hudson vehicular tunnels now under construction for freight service to and from New York, which necessitates an increase in facilities at Jersey City. The new terminal will be a two-level structure constructed to permit later the addition of several stories for warehouse purposes above it. The new track to be built for connection with the terminal will be above the street level, necessitating several steel bridges. The estimated cost of the entire project, of which 50 per cent will be constructed in the initial stage, is placed at $12,938,000.

The Erie has awarded a contract for 96 steel cargo doors for Pier No. 9, now under construction at Jersey City, to the Truscon Steel Company, Youngstown, O. A contract for the fire doors for the new freight pier has been awarded to the J. G. Wilson Company, New York. A contract has been awarded to the Rayen Company, Youngstown, O., for the construction, in 1927, of a warehouse and freight terminal at Youngstown, O., at an estimated cost of $1,000,000.

The Grand Trunk Western is constructing by company forces a 400-car storage yard and industrial lead to serve automobile industries and a 72-car switching lead with the extension of ten tracks to increase the capacity of the latter yard from 525 to 1,500 cars at Pontiac, Mich. A contract for a portion of the grading work has been awarded to the Jones Contracting Company, Pontiac, Mich. The cost of both projects is estimated at $255,000.

The Great Northern has let a contract for the concrete and steel construction of the superstructure of the second section of Dock No. 1 at Allouez, Wis., to Peppard & Fulton, Minneapolis, Minn. Bids will be received during October for the construction of the substructure of the third section while bids for the superstructure of this section will be accepted about September, 1927. The entire project is estimated to cost $2,756,000. A contract has been awarded to Stone & Webster, New York, for the construction of an electrical transmission line in the Cascade mountains, near Skykomish, Wash., incident to the electrification of the line between Gold Bar, Wash., and Wenatchee, which, with the construction of a sub-station, is expected to involve an expenditure of about $704,000. A contract has been awarded to Hanson Brothers for the grading of an industrial branch, 3 miles long to a packing plant at West Fargo, N. D., to cost about $54,000. Bids are being received for three changes in the main line on the Spokane division, estimated to cost $354,000.

The Illinois Central has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 200-ton coaling station at the Denison, Iowa, terminal. Bids are being received until October 25 for the construction of a powerhouse at Paducah, Ky., estimated to cost $300,000.

The Jackson & Eastern has awarded a contract to O. A. Hanna, Jackson, Miss., for the construction of foundations for a 190-ft. steel bridge across the Pearl river, east of

Jackson, the steel erection to be done by company forces. A contract for 21 miles of grading on the 40-mile extension of the line from Lena, Miss., to Jackson, has been let to the S. K. Jones Construction Company, Memphis, Tenn., while grading on the remaining 19 miles has been let to the Dyess Construction Company, Jackson.

The Los Angeles & Salt Lake is preparing plans for the construction of an under-grade highway crossing at Downey road, Los Angeles, Cal., which will be effected by raising 3,200 ft. of double main track, 1,700 ft. of single main track, 1,350 ft. of secondary trackage, relocating and depressing the highway and constructing two 36-ft. deck plate girder spans with two 21-ft. I-beam approach spans over the sidewalks. The total work will cost about $102,000 and bids will soon be asked for the substructure. Company forces will enlarge the bore and reline with reinforced concrete 291 lineal feet of Tunnel No. 18 near Brown, Nev., with an approximate expenditure of $40,000.

The Louisville & Nashville has awarded a contract to the Roberts & Schaefer Company, Chicago, for hoisting machinery to be installed in an existing coaling station at North Hazard, Ky. A contract has been awarded to Reinhardt & Dennis and to the W. J. Sparks Quarry Company for the construction of a new line near Sinks, Ky., which involves the driving of several tunnels.

The Michigan Central has awarded a contract to the Ellington-Miller Company, Chicago, for the construction of a 10-stall reinforced concrete roundhouse at Windsor, Ont., at a cost of $110,000.

The Missouri Pacific has been authorized by the Interstate Commerce Commission to construct an extension of its Hope-Nashville branch from its present terminus at Nashville, Ark., in a general northerly direction for a distance of 7½ miles, at a cost of $193,000. Construction will probably start about November 1, 1926.

A contract has also been awarded to the American Construction Company, Omaha, Neb., for the construction of a concrete and brick freight house at Omaha, at a cost of $220,600. At Osawatomie, Kan., a contract has been let to the J. R. Van Sant Construction Company, Kansas City, Mo., for the construction of a powerhouse and engine room to cost $49,800 and to T. H. Johnson, Sedalia, Mo., for the construction of a one-story brick and steel planing mill to cost $52,500. A contract has been let to S. M. Bate & Co., Kansas City, Mo., for the construction of a brick and concrete freight house, two stories high, at Coffeyville, Kan., at a cost of $101,200. A contract for the construction of a mechanical coaling station at Washington, Mo., has been awarded to the Folwell-Ahlskog Company, Chicago, at an estimated cost of $52,000. At Cricket, Ark., a contract has been let to the Gunite Construction Company, Kansas City, for the relining of a tunnel with a contract price of $83,500.

The New York, New Haven & Hartford has awarded a contract to V. N. Famiglietti & Sons, Inc., for the construction of engine facilities at Greenbush, Mass.

The New York Central has awarded contracts totaling approximately $758,000 as follows: to the National Boiler Washing Company, Chicago, for the installation of a boiler washing and filling system for locomotive boilers in engine house at East Syracuse, N. Y., estimated cost $70,000; to the General Electric Company, New York, for electrical equipment for sub-station at 43rd street, New York, estimated cost $255,000; to H. H. Sherwin & Co., Inc., New York, for the construction of duct lines and splicing chambers between Spuyten Duyvil, N. Y., and Riverdale, N. Y., estimated cost, $150,000; to the Grinnell Company, Inc., New York, for the installation of automatic sprinkler system on Pier F, North River, New York, estimated cost, $33,000; to the Jobson, Gifford Company, New York, for the construction of bridge to eliminate grade crossing at Van Cortlandt Park South over the Putnam division tracks, estimated cost, $110,000; to the L. M. Neckermann Company, New York, for the construction of freight house at West 135th street and 12th avenue, New York, estimated cost, $140,000.

The Northern Pacific has awarded a contract to the Widell Company, Mankato, Minn., for the building of the substructure in connection with the replacement of the bridge across the Mississippi river at Minneapolis, Minn. A contract for fabricating the steel, amounting to 1,300 tons, has been awarded to the American Bridge Company, Chicago, while a contract for the erection of the steel will be let in the near future.

The Oregon Short Line is preparing plans for the installation of a water treating plant at Glenns Ferry, Idaho, at an estimated cost of $41,000, including a concrete treating tank with wood roof, a frame chemical mixing and storage house, 24 ft. by 40 ft., and necessary mixing tanks, machinery and pipe lines. Company forces will contruct a 3,000 ft. spur near Nampa, Idaho.

The Pennsylvania has awarded contracts totaling approximately $950,000 as follows: to the Walsh Construction Company, Davenport, Ia., for grading and masonry for section 1 of double track cutoff from Collinsville, Ill., to St. Jacob, Ill., estimated cost $315,000; to the Walsh Construction Company, Davenport, Ia., for grading and masonry for section 2 of double track cutoff from Collinsville, Ill., to St. Jacob, Ill., estimated cost $300,000; to the George A. Fuller Company, New York, for the construction of new cab ramps and passageways, Pennsylvania Station, New York, estimated cost, $190,000.

The Rio Grande, Micolithic & Northern, organized in the interests of the Micolithic Company, has been authorized by the Interstate Commerc Commission to construct a railroad from a connection with the Galveston, Harrisburg & San Antonio, at a point approximately 123 miles east of El Paso, Tex., in a southerly direction for about 6.4 miles. The estimated cost of construction is $105,721.

The St. Louis-San Francisco will receive bids in the near future for the construction of 57 miles of line from Aberdeen, Miss., to Aliceville, Ala., a portion of the proposed extension from Aberdeen to Kimbrough, Ala., a distance of 152 miles. A contract has been awarded to J. H. Leveck & Son, Little Rock, Ark., for the construction of a combined freight and passenger station at Crystal City, Mo., at a cost of $20,000. A contract has been let to the George Griffiths Construction Company, St. Louis, Mo., for the construction of a combined freight and passenger station at Neosho, Mo., at a cost of about $18,000. This company will also remodel and extend its roundhouse and install a 100-ft. turntable at Kansas City, Mo., at a total cost of $150,000, the contract for building work being let to C. E. Hamilton, Kansas City. Company forces are installing a 100-ft. turntable at Ft. Scott, Kan., at an estimated cost of $42,000.

The Southern Pacific has awarded a contract to the Bellows-MacClay Construction Company, Dallas, for the construction of buildings for the new freight terminal at Dallas, Tex., estimated to cost $1,500,000. This company contemplates the construction, after January 1, 1927, of a 307-ft. by 50-ft. reinforced concrete freight house at Bakersfield, Cal., with an open platform 80 ft. long.

The Southern Pacific of Mexico contemplates the construction of a combination passenger station, custom house and immigration office at Nogales, Sonora, to cost about $160,000. Included in this improvement are the addition of two passenger yard tracks and three team tracks.

The Union Pacific has awarded a contract to Peterson, Shirley & Gunther, Omaha, Neb., for the construction of the foundation, piers, abutments, decking and handrail in connection with the rebuilding of the "L" street viaduct at Omaha. The rebuilding is expected to cost about $95,000. The water station at Columbus, Neb., will be improved by sinking two 110-ft. wells to be operated by motor-driven turbine pumps and by installing a 350,000-gal. steel water tank and a 42,000-gal. water softener at a total cost of $75,500. The improvement will be constructed by company forces with the contract for steel for the tank awarded to the Graver Corporation, Chicago, and for the softener to the Chicago Bridge & Iron Company, Chicago. Company forces will construct 12,400 ft. of additional yard

tracks, relocate 22,000 ft. of existing yard tracks, install a 12-in. standpipe and enlarge the yard office at North Platte, Neb., at an estimated cost of $100,600. A contract has been awarded to the Missouri Valley Bridge & Iron Works, Leavenworth, Kan., for the construction of foundations, piers and abutments in connection with the double tracking of the bridge over the Delaware river near Perry, Kan., at a cost of $189,100. Company forces will erect the steel. A contract for the grading, bridging and culverts on nine miles of branch line and two miles of side track south and west of Gering, Neb., expected to cost $273,000, has been let to C. T. Whelan, North Platte, Neb.

The Venice, Englewood & Southern has been authorized by the Interstate Commerce Commission to extend the time for starting construction of its line in Florida to March 31, 1927, and the time for completion to March 31, 1928.

The Wabash has awarded a contract to the Industrial Track Construction Company, St. Louis, Mo., for the construction of 21.6 miles of second main track from Lima Junction, Ohio, to Britton, Mich., involving an expenditure of approximately $1,400,000.

Equipment and Supplies

The Union Pacific has ordered 23,000 tons of rails from the Illinois Steel Company.

The Northern Pacific has ordered 5,500 tons of rails from the Illinois Steel Company.

The Central of Georgia has ordered 16,000 tons of rails from the Tennessee Coal, Iron & Railroad Company.

The Texas & Pacific has ordered 14,000 tons of rails from the Tennessee Coal, Iron & Railroad Company.

The Florida East Coast has ordered 12,000 tons of rails from the Tennessee Coal, Iron & Railroad Company.

The Nashville, Chattanooga & St. Louis has ordered 5,000 tons of rails from the Tennessee Coal, Iron & Railroad Company.

The Chicago, Milwaukee & St. Paul has ordered 50,000 tons of rails, a part of which was placed with the United States Steel Corporation.

The Illinois Central has ordered 31,000 tons of rails from the Tennessee Coal, Iron & Railroad Company, and 35,000 tons from the Illinois Steel Company.

The Reading has divided an order of 36,000 tons of rail between the Bethlehem Steel Company and the Carnegie Steel Company. Practically all of this rail is to be of 130-lb. section.

The Louisville & Nashville has authorized the purchase of 67,600 tons of rails and is inquiring for 1,500 kegs of spikes, 3,500 kegs of track bolts and 25,000 pairs of angle bars.

The New York Central has placed orders for rails for 1927, aggregating 227,675 tons as follows: Bethlehem Steel Company, 95,750 tons; Illinois Steel Company, 89,000 tons; Inland Steel Company, 21,350 tons; Carnegie Steel Company, 18,625 tons; and Algoma Steel Company, 2,950 tons. About 60 per cent of this rail will be 105 lb. and all but 3,000 tons will be 105-lb. or heavier.

The Pennsylvania has placed orders for rail for 1927 delivery, aggregating 160,000 tons, as follows: Bethlehem Steel Company, 70,000 tons; Carnegie Steel Company, 50,000 tons; Illinois Steel Company, 30,000 tons; and Inland Steel Company, 10,000 tons. The railroad has reserved the right in each case to increase the tonnage of the order by 25 per cent.

The Atchison, Topeka & Santa Fe has ordered 144,930 tons of rails, of which 14,720 tons of 110-lb. rail, 39 ft. long will be supplied by the Illinois Steel Company, and 70,245 tons of the same size will be supplied by the Colorado Fuel & Iron Company, which will also furnish 44,865 tons of 90-lb., 39-ft. rail. The Inland Steel Company will furnish 15,000 tons. In addition the company has ordered 3,033 tons of tie plates from the Illinois Steel Company and 14,077 tons from the Colorado Fuel & Iron Company.

Supply Trade News

General

The Cleveland offices of the **Central Alloy Steel Corporation** and the **United Alloy Steel Corporation** have been combined and moved to 1716 Union Trust Building.

The Chicago Pneumatic Tool Company, Chicago, plans the construction of a plant at Franklin, Ill., at an approximate cost of $500,000, for the manufacture of Diesel engines.

The Positive Lock Washer Company, Newark, N. J., has appointed the **Lundie Engineering Corporation,** New York, its exclusive railroad sales agent for the United States and Canada.

The Marion Steam Shovel Company, Marion, Ohio, is planning the construction of a factory branch and distributing plant 45 ft. by 110 ft., at Kansas City, Mo., to cost approximately $45,000.

The name of the **Wayne Tank & Pump Company,** Ft. Wayne, Ind., has been changed to the **Wayne Company,** the change in no way affecting the business status or policies of the company.

The National Pole & Treating Company, Minneapolis, Minn., has been organized through the consolidation of the **American Cedar Company** and the **Northern Tie & Treating Company.** The officers of the new company are: **H. S. Gilkey,** chairman of the board; **Seymour W. Backus,** president; **L. A. Furlong** and **F. G. Moore,** vice-presidents; and **William F. Brooks,** secretary and treasurer.

Personal

William J. Watson, founder of the Buda Company, and at one time its president, died on October 1, at his home in Chicago, at the age of 83.

J. R. Sexton, manager of the railroad department of the H. H. Robertson Company, has been transferred from Chicago to the general offices of the company at Pittsburgh, Pa.

L. T. Pockman, manager of the Los Angeles district of the Chicago Pneumatic Tool Company, with headquarters at Los Angeles, Cal., has been promoted to Pacific coast manager.

R. E. McKee, assistant manager of the tie and timber department of the Long-Bell Lumber Company, with headquarters at Kansas City, Mo., has been promoted to manager of the New York sales office.

F. R. Pfaff, assistant advertising manager of Albert Pick & Co., has been appointed advertising manager of the Independent Pneumatic Tool Company, Chicago, to succeed **Frank F. Leavenworth,** who has resigned to engage in other business.

Arthur Craine, district engineer maintenance of way on the Chicago, Burlington & Quincy, with headquarters at St. Louis, Mo., has resigned to become representative of the American Hoist & Derrick Company, St. Paul, Minn., with headquarters at St. Louis. Mr. Craine was born in England in 1883, and entered railway service in 1905 as a rodman on the Missouri Pacific. In 1908, he became a rodman on the Chicago, Burlington & Quincy, and through successive promotions became district engineer maintenance of way in 1921, which position he was holding at the time of his recent appointment as representative of the American Hoist & Derrick Company.

The fiftieth anniversary of the completion of the first railroad connecting Los Angeles with the outside world was celebrated at Lang, Cal., on September 5. An historic old train was run from Los Angeles to Lang, carrying Mayor Cryer and a party of more than 200 pioneer settlers, railroad men and members of the Chamber of Commerce. This train was met at Lang by a modern train from San Francisco, carrying a similar delegation.

What Is Chemical Weed Killer?

There are many chemicals injurious to vegetation in varying degrees. However, here are the fundamental characteristics of an ideal weed killer.

1st—KILLING ACTION—Must definitely destroy the life giving process of the plant, not merely burn by contact.

2nd—SAFETY—Must be harmless to the track structure, non-poisonous to animals, and safe to handle.

3rd—CONCENTRATION—Must be sufficiently concentrated for economical transportation.

4th—DISTRIBUTION—Must be capable of proper dilution with water, and distribution by means of a simple and easily operated spraying equipment.

5th—PRICE—Must be effective in proportion to the cost per mile of track.

There is only ONE chemical on the market which affords the combination of all these advantages—ATLAS N-P.

Certain classes of chemicals are injurious to vegetation by contact, but cannot be regarded as poisonous or be applied in sufficient quantity to have an appreciable effect. Common salts or chlorides of earth metals are in this class.

Owing to the success of ATLAS NON-POISONOUS WEED KILLER, chemicals have been sold in imitation of it during the past season which entirely lacked the active agent of ATLAS N-P, the use of which is patented. These chemicals also had the disadvantage of being highly corrosive. Chemical weed killer is not a plaything for the incompetent, but is a labor saving device when in the hands of experienced men.

Over a million gallons of ATLAS WEED KILLERS were successfully used by railroads in this country last year.

ATLAS "A" is a STANDARD Weed Killer with seventeen years of railroad work back of it.

ATLAS N-P is the only practical non-poisonous weed killer on the market, and has been used very successfully for the past two years by leading railroad systems.

ATLAS
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SERVICE

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Sole Licensee for Non-poisonous Weedkiller Under United States Patent No. 1,534,289

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"Improved" O. G. FIR GUTTERS

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Last Longer

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Selected by 21 Railroads

WHY have twenty-one prominent railroads (names upon request) chosen "Improved" O. G. Fir Gutter as part of their standard equipment in preference to metal gutter?

Here's the reason: "Improved" O. G. Fir Gutters are not disintegrated by smoke, fumes or acids, or by the elements. They last the life of the building and there is practically no upkeep expense. Trim, neat—this gutter adds to the appearance of any railroad building. Yet they cost no more than the ordinary metal trough. Many railroads are using them to replace disintegrated metal gutters.

"Improved" O. G. Fir Gutter, made of durable Douglas Fir, comes in convenient stock sizes of 3x5″, 4x6″ and 5x7″ in 10 to 40 foot lengths.

Send today for booklet giving detailed description, sample gutter and our current prices.

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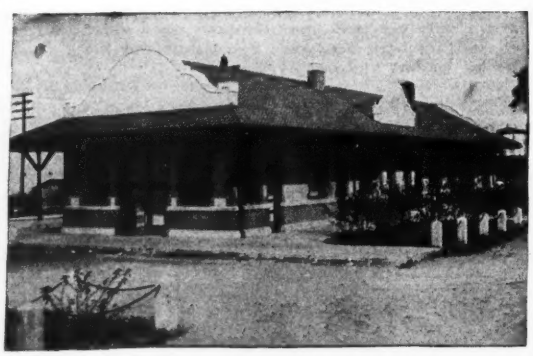

"Improved" O. G. Fir Gutters make a neat and permanent finish on this station.

STATEMENT of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of *Railway Engineering and Maintenance*, published monthly at Chicago, Ill., October 1, 1926.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared E. A. Simmons, who, having been duly sworn according to law, deposes and says that he is the President of the Simmons-Boardman Publishing Co., publisher of *Railway Engineering and Maintenance*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Simmons-Boardman Publishing Co., 30 Church St., New York, N. Y.

Editor, Elmer T. Howson, 608 South Dearborn St., Chicago, Ill.

Managing Editor, Walter S. Lacher, 608 South Dearborn St., Chicago, Ill.

Business Manager, F. C. Koch, 90 Church St., New York, N. Y.

2. That the owner is:
Simmons-Boardman Publishing Co., New York, N. Y. Owners of 1 per cent or more of the total amount of capital stock are: Edward A. Simmons, New York, N. Y.; Henry Lee, New York, N. Y.; Cecil R. Mills, New York, N. Y.; George Slate, New York, N. Y.; Roy V. Wright, New York, N. Y.; Thomas Prosser & Son, New York, N. Y.; Herbert L. Aldrich, New York, N. Y.; Samuel O. Dunn, Chicago, Ill.; Carrie E. Dunn, Chicago, Ill.; Lucius B. Sherman, Chicago, Ill.; Elmer T. Howson, Chicago, Ill.; Frederick H. Thompson, Cleveland, Ohio.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: There are none.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

E. A. SIMMONS,
President.

Sworn to and subscribed before me this 28th day of September, 1926.

[SEAL] H. D. NELSON.
(My commission expires March 30, 1927.)

CAST IRON *Pipe for Permanence*

Every day the Florida East Coast Railway runs forty-eight "100 car" trains over these Culverts

DAY in and day out, for the past eighteen months, the SPI-COR (Spiral Corrugated) cast iron pipe in these culverts has withstood the terrific impact of 48 trains.

Forty-eight trains of 100 cars each, pulled by a 150-ton locomotive.

And look at the picture! A loose sand fill. The whole crushing weight on the pipe. Railway engineers will appreciate this has proved no ordinary test—yet today these culverts show no sign of rust, wear or depreciation.

These qualities are built into the pipe—the "prove out" in every installation—let us tell you the six sound reasons why SPI-COR Cast Iron Pipe is now so generally used in railway culvert construction.

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Cast Iron Spiral Corrugated Culvert Pipe

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Takes up less room than rigid posts

USED ON OVER 70 RAILROADS

This cut shows a large and exceedingly busy freight yard where 23 stops have been installed for 6 years with no maintenance cost.

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Satisfied Users Are Those Who Come Back For More

These Railroads acknowledge their satisfaction with Layne Wells and Pumps by coming back for more.

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St. Louis & Southwestern R.R. 4 St. Louis & San Francisco R.R. 4 Erie R.R. 3
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Layne Well Systems will produce more water at less cost than any other known method. Once a Layne user, always a Layne user.

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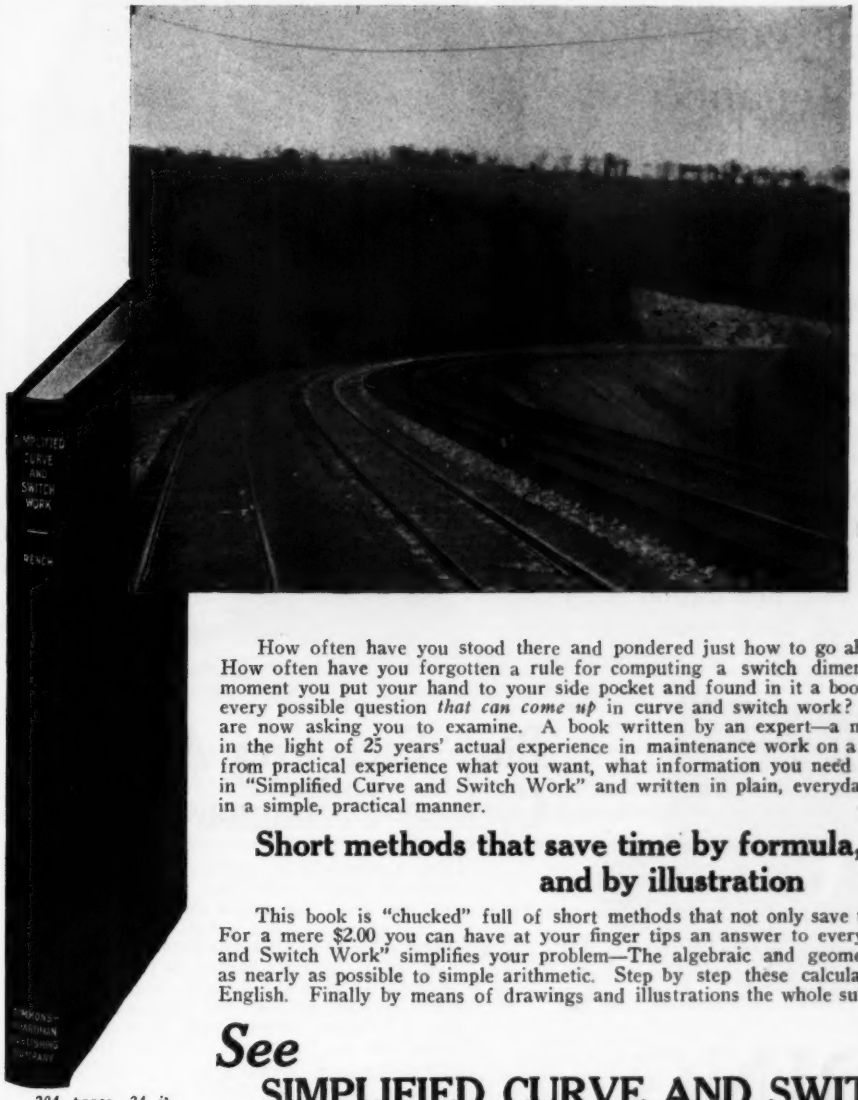

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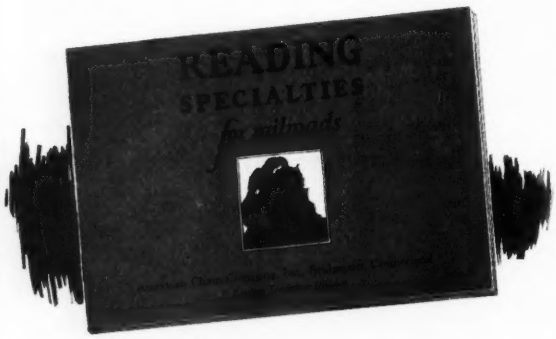

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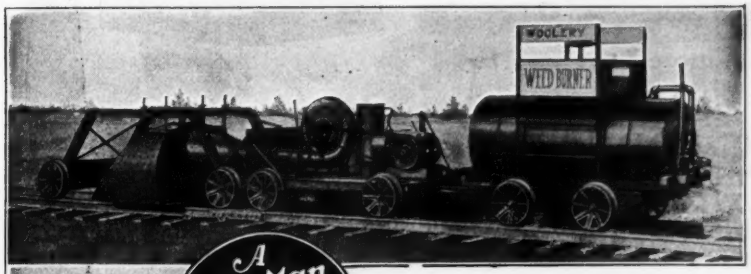

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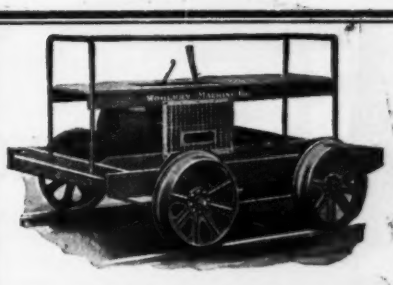
(Patent Applied For)

have blazed their way into popularity with the railroads of the United States.

They have set a new low standard of costs for ridding tracks of weeds. The most stubborn varieties burn to a crisp when the heavy blast of volcanic heat is turned on and are totally consumed. There is no "survival of the fittest" in the trail of Woolery Weed Burners. Destruction is quick, final —and cheap.



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The Composite Spreader-Ditcher, which is the Jordan Spreader with the composite Spreader-Ditcher Attachment, performs all the functions of the Spreader (moves earth, spreads bulky materials, plows snow) and in addition will shape the ballast and subgrade, form new ditches or clean old ones, and trim the banks of cuts to a uniform slope.

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"Does the Work of an Army of Men"
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The renewal of bumping posts is a mighty expensive proposition, and with the ordinary bumping post these renewals come all too frequently.

"Durable" Bumping Posts are just what the name signifies—**they're durable.** The construction of the "Durable" is simple, yet sturdy beyond the ordinary requirements of a bumping post. The bumping head is a cast iron block supported by front legs of special quality soft steel 80 pound rail section and rear legs of 12-inch, 35-pound structural steel channel. The "Durable" is an entirely-above-ground post, and by its unique design it transmits shocks and impacts down to the track rails. This places the burden of the shock where it rightfully belongs and where it can best be absorbed.

Standardization on "Durable" Bumping Posts will show a very marked reduction in the number and cost of bumping post renewals.

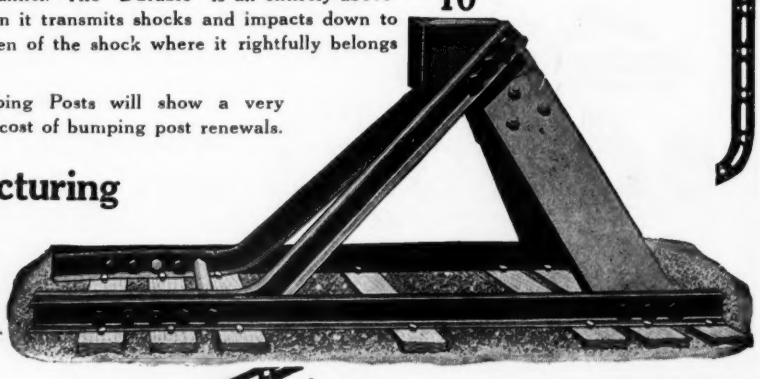
Mechanical Manufacturing Company

Pershing Road and Loomis Street
Chicago, Illinois

Room 323-E Hudson Terminal Bldg.
30 Church St., New York City
Telephone Cortlandt 1331

It Stops

1. Excessive Cost of Installation.
2. Waste of Valuable Track Space.
3. Unnecessary Digging up of Track.
4. Uncertainty as to its Condition.
5. Jeopardy to Property and Human Life.
6. Troubles in Winter Moving.
7. Carrying Large Stock of Repair Parts.
8. Frequent Renewals
9.
10.



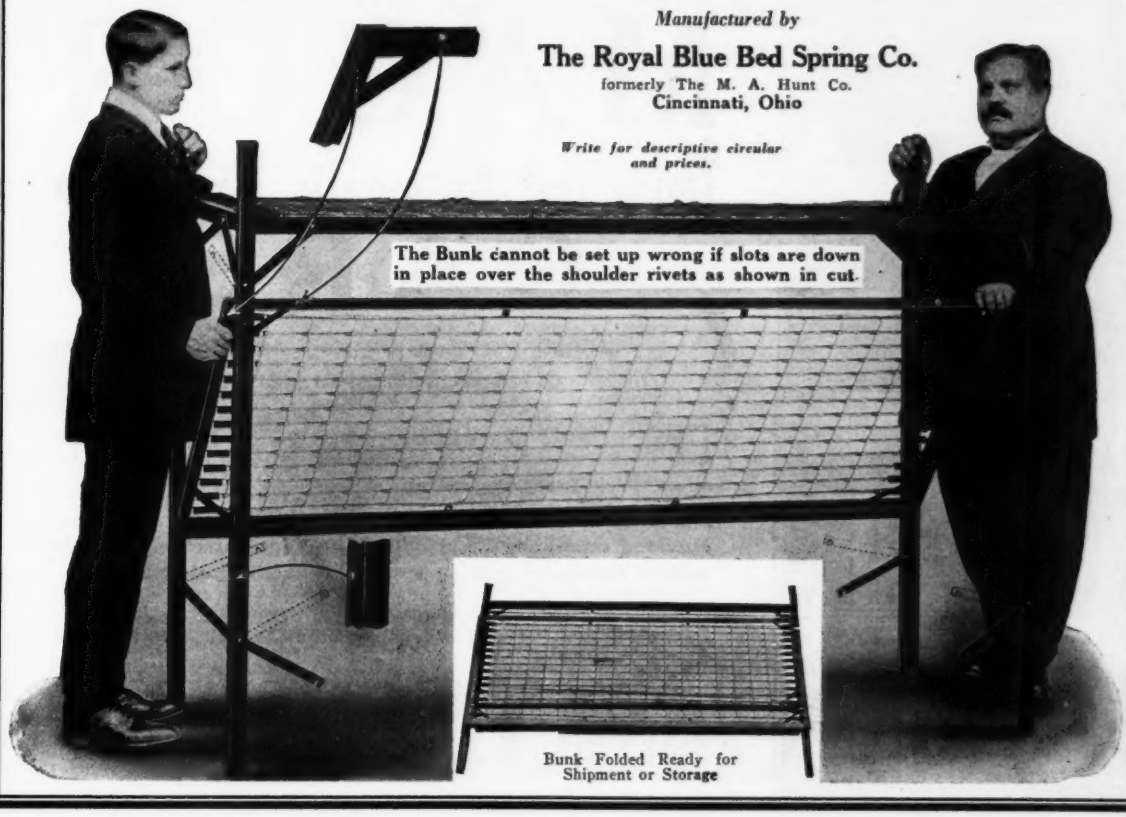
The Durable Freight Bumping Post stands like a sentinel at the end of the track—stopping all cars which attempt to pass.

Manufactured by

The Royal Blue Bed Spring Co.

formerly The M. A. Hunt Co.
Cincinnati, Ohio

Write for descriptive circular and prices.


The Bunk cannot be set up wrong if slots are down in place over the shoulder rivets as shown in cut.
Bunk Folded Ready for Shipment or Storage

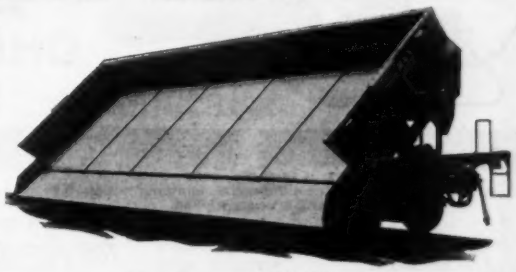
A Successful Car

The Koppel Automatic Air Dump Car, with its many advantages of both construction and design has appealed to everyone who has examined it.

The Lift Door type is made in capacities of 12, 16, 20, 30 and 45 yards—the drop door type in capacities of 12 to 30 yards.

An economical, positive-acting car that you will like.

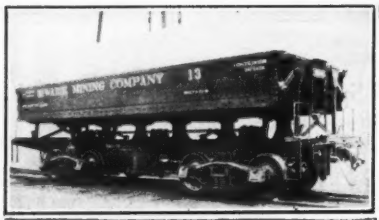
Literature upon request.

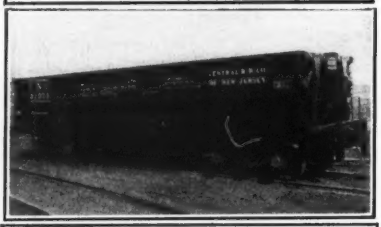


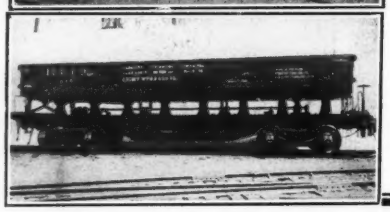
Drop Door and Lift Door type

KOPPEL INDUSTRIAL CAR & EQUIPMENT CO.
Koppel **Penna.**

Sales Offices
Pittsburgh New York Chicago San Francisco







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Improved Automatic Air Dump CARS

Are built to serve a rapidly widening range of railroad requirements

DESIGNED to produce the most satisfactory results with lowest possible operating costs, maximum safety of operation, quick discharge and return.

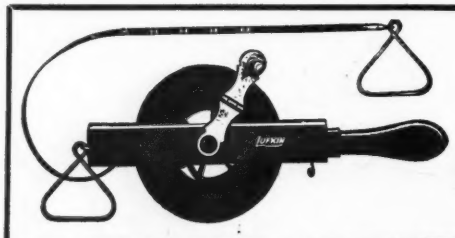
Dumping can be controlled from locomotive or cars can be operated separately. Cars dump in either direction instantly without change of parts or any preliminary adjustment.

20 cu. yds. 40 Tons — *Write for Catalogue "D" with description and prints* — **30 cu. yds. 50-70-75 Tons**

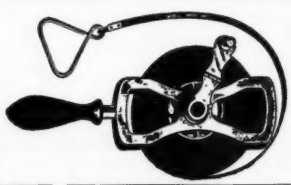
MAGOR CAR CORPORATION

30 Church St. **New York City**

Works: Passaic, N. J.



LUFKIN CHAIN TAPES



ETCHED TAPE No. 5100
A sturdy tape best for all precise chaining work. ½-gage mark when specified.

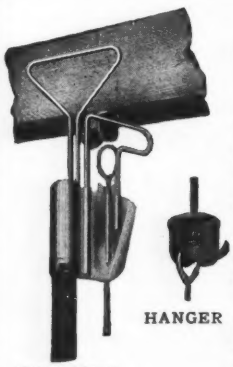
"MICHIGAN" CHAIN TAPE
Graduated on Babbitt Metal
Most popular for rough survey and maintenance work. ½-gage mark when specified.

ENGINEER'S PATTERN TAPES — WOVEN TAPES OF ALL GRADES

Send for Catalogue

WINDSOR, ONT. LONDON, ENG. — **THE LUFKIN RULE CO.** — **SAGINAW, MICH. NEW YORK**

Do You Know?



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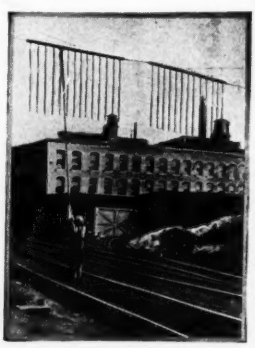
REPLACER

TELL-TALES On Bridge and Tunnel Warnings

Can now be taken down and replaced by one man from the ground.
No more need of sending a crew of 3 or 4 men over your road with a long ladder, and climbing to the cross arm.
No more tangling of tell-tales.
BRONZE HANGERS — no corrosion or rust — everlasting — TELL-TALES of spring brass rods and treated rope, most resistant to bending.
You can eliminate almost your entire labor and replacement costs and make your bridge and tunnel warnings 100% efficient.
Avoid death and injuries to employees.

Hastings Signal & Equipment Co.

53 State Street **Boston, Mass.**



HASCO METHOD

Bethlehem Parallel Throw Switch Stand, Model 1222 —unusual Safety Features

Bethlehem Parallel Throw Switch Stand, Model 1222 is unusual with its low height, strength and simplicity. It is lower than the rail (only 4¼ in. high from tie to bottom of lamp tip). Low height and parallel throw lever make it particularly desirable for use in confined locations.

Bethlehem Model 1222 is built up of but three moving parts, is easy to throw, boltless, and readily adjustable (range of adjustment, 3½ in. to 6 in.). One Model 1222 installed almost four years ago has been thrown over 600,000 times.

BETHLEHEM STEEL COMPANY *General Offices* **Bethlehem, Pa.**

District Offices in the following cities:

New York Boston Philadelphia Baltimore Washington Atlanta Pittsburgh Portland
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Bethlehem Steel Export Corporation, 25 Broadway, New York City, Sole Export of Our Commercial Products

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Mono-cast Pipe Is Economical

Frequently the largest item in a construction program is the cost of the pipe. Therefore the economies possible by the use of Acipco Mono-cast Centrifugal pipe are very much worth while.

In equal weights and metal thickness, Mono-cast is delivered on your job one to three cents per foot less in cost than old style sand cast pipe.

In the lighter weights (good for higher working pressures) Mono-cast, delivered along your trench, will save you 10% to 15% in cost alone.

Mono-cast Specifications mailed on request. Write for a copy.

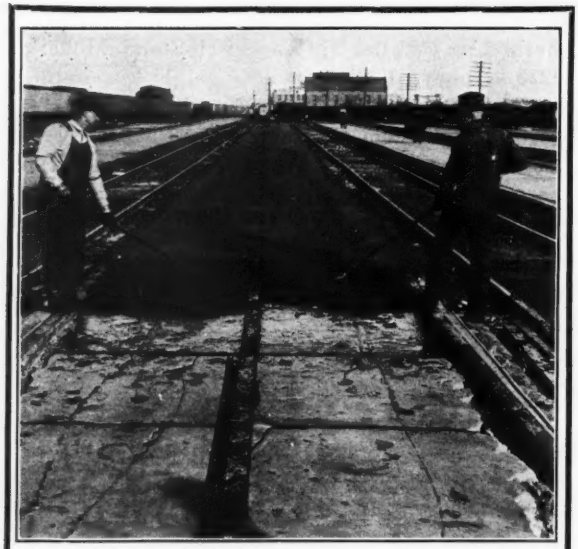
AMERICAN CAST IRON PIPE COMPANY
BIRMINGHAM, ALA.

TRADE MARK

ACIPCO MONO-CAST CENTRIFUGAL PIPE
BELL AND SPIGOT

[MONO-CAST MEANS MADE AS A UNIT—AN INTEGRAL CASTING, EVERY PART OF WHICH IS FORMED AT THE SAME MOMENT BY CENTRIFUGAL FORCE]

"Mono-cast" is the trade mark of the American Cast Iron Pipe Company



Atlantic Coast R. R. makes new ones out of old ones at Florence, S. C.

Kyrock

makes worn concrete platforms SMOOTH quickly—cheaply.

Old concrete platforms which have become rough, like the one pictured above, are quickly made smooth and resilient with a "Kyrock" surface. That saves your investment in the old base, saves 9/10 of the time required for new construction—another saving on the cost of construction and gives you a smooth, resilient pavement that will show no appreciable abrasive wear under steel-tired traffic. Worn brick, block or macadam, may be converted in the same way. "Kyrock" makes the ideal grade crossing—write for data.

"Kyrock" is laid *cold*. Stored in the open without damage. *It retains its life*. Cut it for track repair and the refill bonds under traffic. Perfect water-proofing and non-conductor. "Kyrock" is foolproof—requires no mixing or heating. Any section crew can lay it successfully without special equipment. It offers you simpler construction, longer life, easier maintenance.

Write today for your copy of "Kyrock for Railway Construction and Maintenance."

KENTUCKY ROCK ASPHALT CO.
INCORPORATED
Louisville, Ky.

Kyrock The **Perfect Pavement**

KENTUCKY ROCK Kyrock ASPHALT

LIME-SODA WATER SOFTENERS

We make LIME-SODA WATER SOFTENERS of both the ground operated and top operated types to purify water for prevention of scale deposits and corrosion in locomotive boilers.

There is no investment that a railroad can make which will yield greater dividends, if it operates in a hard water district, than to invest in AMERICAN LIME-SODA WATER SOFTENERS.

At the present time we are installing WATER SOFTENERS on four well-known AMERICAN RAILROADS, on which we made our first installations more than twenty years ago. These plants represent additional repeat orders we have gotten for new plants and enlargements during this time.

Will you please let us have your specifications for water treating plants?

We are qualified by organization and experience to give you service. Write for our literature.

AMERICAN WATER SOFTENER CO.
FAIRHILL P. O. PHILADELPHIA, PA.

Specialists for twenty-four years in Railroad
WATER PURIFICATION

What have you that can be made of PRESSED STEEL 1-8 to 5-16 inch?

WITH ample capital, unsurpassed facilities and successful management this company is looking ahead for means of diversifying lines through manufacture of one or two additional items.

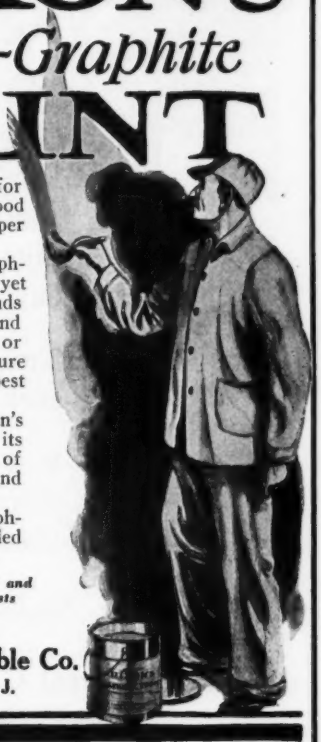
A Rare Opportunity for Inventors and Engineers

If you have an article which can be manufactured and sold on a royalty basis or wish to sell outright get in touch with us by mail at once.

Write fully and send drawings, sketches, blue prints or patent descriptions with information as to market. What you write will be held in strictest confidence. If you have nothing, perhaps you will draw attention of some friend to this advertisement, Address "Development Department."

The Midland Steel Products Co.
P. O. Box 419
CLEVELAND, OHIO

DIXON'S
Silica-Graphite
PAINT



gives better protection for all exposed metal or wood work at lowest cost per year.

The pigment, silica-graphite, provides a tough, yet elastic, film that expands and contracts with heat and cold without cracking or peeling. The vehicle is pure boiled linseed oil—the best paint vehicle known.

Many users of Dixon's Paint have certified to its long service record of from five to ten years and even more.

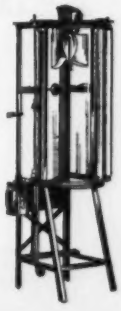
Dixon's Red Lead-Graphite Primer is recommended for priming coats.

Write now for Booklet 187-B and learn how to reduce paint costs

Established 1827

Joseph Dixon Crucible Co.
JERSEY CITY, N. J.

The Pease Junior Blue Printing Machine requires a floor space of only 22x26 inches.



The Pease Junior Sheet Washer will accommodate a blue print 24x36 in.

For the Moderate User of Blue-Prints

Now every drafting room, no matter how small, may enjoy the advantage of making perfectly finished blue prints whenever wanted. No special electrical connections are needed as the Pease Junior can be connected to the lighting circuit and will operate on either 110 volt or 220 volt AC or DC current.

No more open bath trays, dripping prints, and wet floors. The Pease Junior Machine and Sheet Washer eliminate all that and offer speedy operation—high quality work—durable construction and low price.

Write for Pamphlet MJ-54

THE C. F. PEASE COMPANY
854 North Franklin Street
Chicago, Illinois

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should use

Murdock
Drinking Fountains

Because they are constant in service, fool-proof, practically indestructible and therefore especially adapted to railroad service.

Pedestal Fountains
Wall Fountains
MURDOCK Patent Bubbler Head
MURDOCK PATENT Outdoor Bubble Font, anti-freezing
"Genuine" Murdock Compression and Self-closing Hydrants
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Railway Water Service Boxes for train sheds, coach yards and cinder pits

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Makers of Outdoor Water Devices Since 1853

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Tisco Manganese Steel, introduced by Wharton in steam railroad trackwork in 1900, is still used by the leading railroads of the country, the quality having kept pace with the increased demands.

Plant: Easton, Pa.

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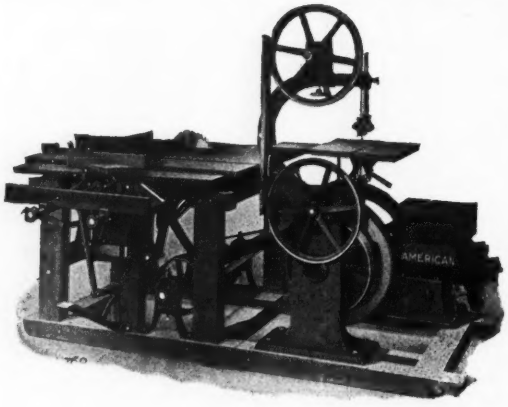

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Tip it over several times.

It will work till that charge is used up.

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--when Barber Brand Cold Repair Cement is used instead of planks. Not only lower in first cost and more durable for grade crossings, station platforms, foot walks, etc., but they actually help to pay for themselves because they eliminate the thousands of dollars of damage claims which spring from accidents due to broken planks.

Barber Brand Cold Repair Cement

is easily, quickly and inexpensively laid. Used COLD—right from the barrel, without the trouble of heating and without cumbersome equipment. Widely used by leading railroad systems.

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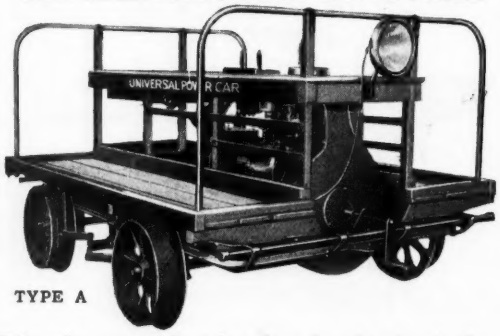
UNIVERSAL POWER CAR
FOR MAINTENANCE-OF-WAY FORCES



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DEPENDABLE—ECONOMICAL—FLEXIBLE
CAN BE OPERATED BY UNSKILLED WORKMEN
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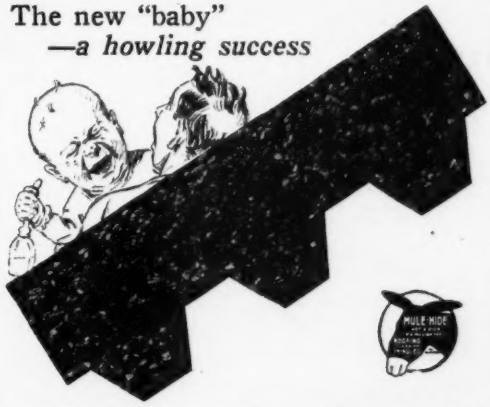
Four men Can Easily Remove Car from Tracks

THE EUCLID ELECTRIC & MFG. CO.
EUCLID, OHIO

The new "baby"
—a howling success



THAT the new "baby"—our Mule-Hide Super 3-Tab Hex Shingle—has been received into wide open arms is evident from the many requests that have come to us for his "likeness"—viz., a full sized sample.

More seriously, this new design slab shingle, weighing about 2 lbs., measures 12 inches x 36 inches and only 100 are required to cover a square. Application is 4 inches to the weather thus giving 50% triple thickness and 100% double coverage over the roof.

May we not send you a sample of the new "baby" that bears promise of being a giant one of these days? Your choice of seven colors: Red, Green, Blue-Black, Onyx, Terra Cotta, Golden Brown and Rainbow.

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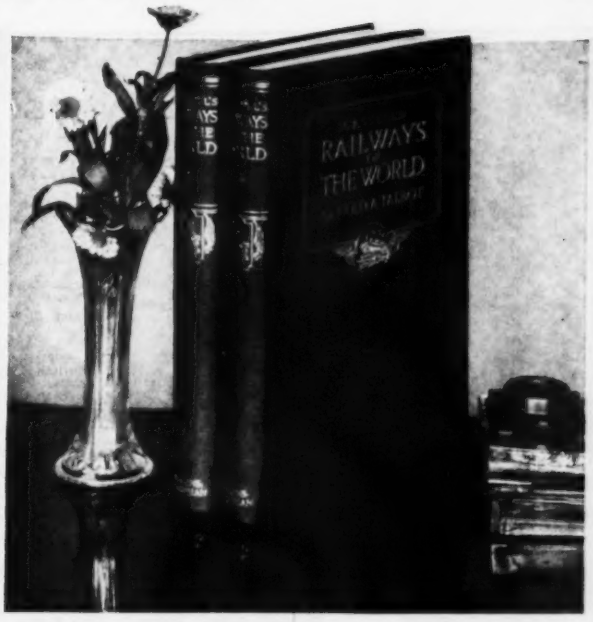
SULLIVAN TRADE MARK MACHINERY COMPANY
411 Peoples Gas Bldg., Chicago

SULLIVAN AIR LIFT



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See Buckets, Clamshell

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McMyler Interstate Co.

Coaling Stations
Fairbanks, Morse & Co.

Combination Crane Pile Driver
Industrial Works

Compressors
Gardner Governor Co.
Ingersoll-Rand Co.
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Compromise Joints
See Joints, Compromise

Concrete Units, Miscellaneous
Federal Cement Tile Co.
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Industrial Works
McMyler Interstate Co.

Creosoted Timber
See Timber, Creosoted

Cribbing, Concrete
Federal Cement Tile Co.
Massey Concrete Products Corp.
R. C. Products Co., Inc.

Crossing Gates
Buda Co.
Kalamazoo Railway Supply Co.

Crossings, Highway
Barber Asphalt Co.
Kentucky Rock Asphalt Co.

Crossings, Rail
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
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Crushers, Stone
Western Wheeled Scraper Co.

Culvert Pipe
American Cast Iron Pipe Co.
American Casting Co.
Armco Culvert & Flume Mfrs. Assn.
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Curbing
Massey Concrete Products Corp.

Derails
American Chain Co., Inc.
Q & C Co.
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Derrick Cars
Maintenance Equip. Co.

Derricks
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Diesel Engines
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Dieing Machines
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Disinfectants
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Ditchers
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Ditching Machinery
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Drills, Earth
Buda Co.

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Ingersoll-Rand Co.
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Verona Tool Works

Drill Steel, Rock
Ingersoll-Rand Co.
Sullivan Machinery Co.

Drills, Track
Buda Co.
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Kalamazoo Railway Supply Co.
Railroad Accessories Corp.

Drinking Fountains
Murdock Mfg. & Supply Co.

Dump Cars
Clark Car Co.
Jordan Co., O. F.
Koppel Industrial Car & Equipment Co.
Western Wheeled Scraper Co.

Dynamite
Du Pont de Nemours Co., Inc., E. I.

Electric Cranes (Locomotive, Pillar, Transfer & Wrecking)
See Cranes

Electric Light & Power Plants
Fairbanks, Morse & Co.

Electric Power Units
Electric Tamper & Equipment Co.
Euclid Electric Co.
Northwestern Motor Co.

Electric Snow Melters
Q & C Co.

Engines, Gasoline
Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Ingersoll-Rand Co.
Kalamazoo Railway Supply Co.
Mudge & Co.
Northwestern Motor Co.
Woolery Machine Co.

Engines, Hoisting
McMyler Interstate Co.

Engines, Motor Car
Buda Co.
Euclid Electric & Mfg. Co.
Fairbanks, Morse & Co.
Fairmont Railway Motor Co.
Kalamazoo Railway Supply Co.
Mudge & Co.
Northwestern Motor Co.
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Engines, Oil
Buda Co.
Fairbanks, Morse & Co.
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Du Pont de Nemours & Co., Inc., E. I.

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Cyclone Fence Co.
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Cyclone Fence Co.
Interstate Iron & Steel Co.

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Maintenance Equip. Co.
Massey Concrete Products Corp
Q. & C. Co.

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Bethlehem Steel Co.
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Bethlehem Steel Co.
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Girder Rails
Bethlehem Steel Co.

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Western Wheeled Scraper Co.

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Western Wheeled Scraper Co.

Graphite
Dixon Crucible Co., Jos.

Grinders, Portable
Buda Co.
Ingersoll-Rand Co.

Guard Rails
American Chain Co., Inc.
Bethlehem Steel Co.
Buda Co.
Q. & C. Co.
Ramapo Ajax Corp
Wharton Jr. & Co., Wm.

Guard Rail Clamps
American Chain Co., Inc.
Bethlehem Steel Co.
Buda Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Gutters, Wood
Long & Sons, E. M.

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Ingersoll-Rand Co.
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Sullivan Machinery Co.

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Hydrants, Fire
Murdock Mfg. & Supply Co.

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Inspection Cars
See Cars, Inspection

Insulated Rail Joints
Bethlehem Steel Co.
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Insulating Material
Barber Asphalt Co.
Lehon Co.

Jacks, Bridge
Buda Co.
Kalamazoo Railway Supply Co.

Jacks, Track
Buda Company
Hackmann Railway Supply Co.
Kalamazoo Railway Supply Co.
Verona Tool Works

Joints, Compromise
American Chain Co., Inc.
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Q. & C. Co.
Rail Joint Co.

Joints, Rail
American Chain Co., Inc.
Bethlehem Steel Co.
Inland Steel Co.
Q. & C. Co.
Rail Joint Co.
Wharton Jr. & Co., Wm.

Joints, Step
American Chain Co., Inc.
Inland Steel Co.
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Locomotive Cranes
Industrial Works

Lubricants
Dixon Crucible Co., Jos.

Manganese Track Work
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Manholes
Massey Concrete Products Corp.

Markers
Massey Concrete Products Corp.

Mile Posts
Massey Concrete Products Corp.

Motor Car Accessories
Mudge & Company

Motor Cars
See Cars, Motor

Motors and Generators
Fairbanks, Morse & Co.

Mowing Machines
Fairmont Railway Motors, Inc.
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Bethlehem Steel Co.
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Oil Engines
See Engines, Oil

Out Houses
Massey Concrete Products Corp.

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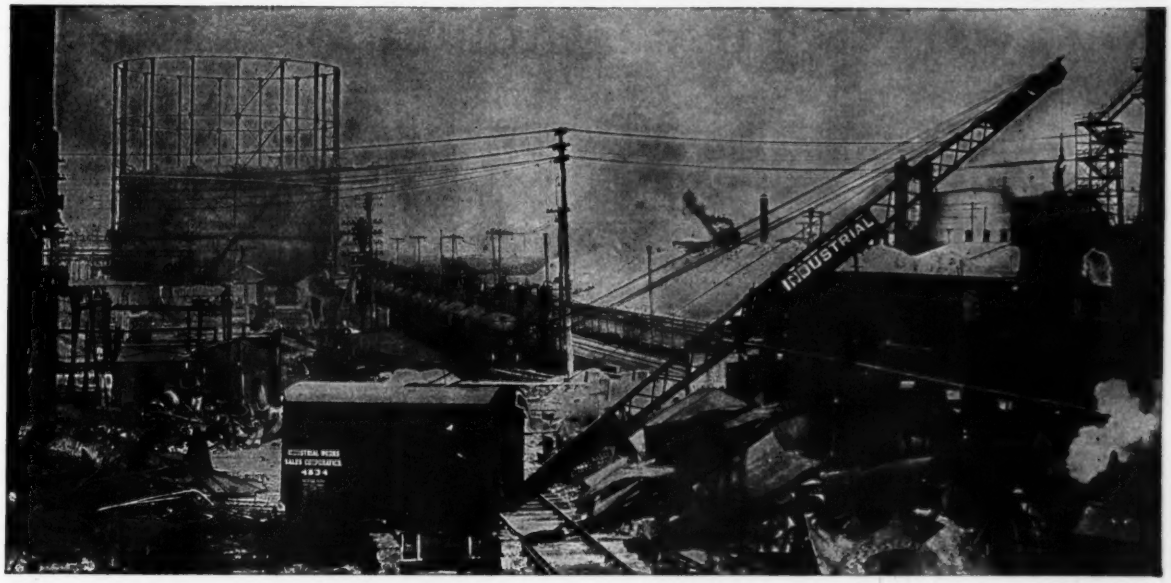
Barber Asphalt Co.
Dixon Crucible Co., Jos.



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Pipe, Cast Iron
American Cast Iron Pipe Co.
American Casting Co.
Cast Iron Pipe Publicity Bureau

Pipe Carriers
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Pipe, Concrete
Massey Concrete Products Corp.

Pipe, Corrugated
Armco Culvert & Flume Mfrs. Ass'n

Pipe, Sewer
Massey Concrete Products Corp.

Pipe Joint Compound
Dixon Crucible Co., Jos.

Plows, Railroad
Western Wheeled Scraper Co.

Poles
International Creosoting & Construction Co.
Massey Concrete Products Corp.

Post Hole Digger
Buda Company

Posts, Fence
See Fence Posts

Posts, Bumping
See Bumping Posts

Powders, Blasting
Du Pont de Nemours & Co., Inc., E. I.

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Midland Steel Products

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Buda Company
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Mudge & Co.

Rail Anchors
Bethlehem Steel Co.
Lundie Engineering Corp.
P. & M. Co.
Verona Tool Works

Rail Anti-Creepers
See Anti-Creepers, Rail

Rail Benders
American Chain Co., Inc.
Buda Co.
Q & C Co.
Verona Tool Works

Rail Bonds
Verona Tool Works

Rail Braces
Bethlehem Steel Co.
Buda Co.
Q & C Co.
Ramapo Ajax Corp.
Wharton Jr., & Co., Wm.

Rail Crane
Parsons Company

Rail Expanders
Ramapo Ajax Corp.

Rail Joints
See Joints, Rail

Rail Layers
Maintenance Equip. Co.

Rail Saws, Portable
Industrial Works
Kalamazoo Railway Supply Co.
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Rail Springs
Verona Tool Works

Rail, Tee
Bethlehem Steel Co.
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Oxweld Railroad Service Co.

Removers, Paint
Mudge & Co.

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American Chain Co., Inc.
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Rivets
Bethlehem Steel Co.
Inland Steel Co
Interstate Iron & Steel Co.

Rods, Welding
Oxweld Railroad Service Co.

Rods, Wire
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Roofing Composition
Barber Asphalt Co.
Lehon Co.

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Ingersoll-Rand Co.

Section Cars
See Cars, Section

Sharpeners, Rock Drill Steel
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Barber Asphalt Co.

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Barber Asphalt Co.
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Snow Plows
Jordan Co., O. F.
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Bethlehem Steel Co
Inland Steel Co.
Interstate Iron & Steel Co.

Spreader Cars
See Cars, Spreader

Spreaders, Ballast
See Ballast Spreaders

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Fairbanks, Morse & Co.

Stands, Switch & Target
Bethlehem Steel Co.
Q & C Co.
Ramapo Ajax Corp.

Steel, Alloy
Interstate Iron & Steel Co.

Steel, Structural
Bethlehem Steel Co.
Inland Steel Co.

Steel Plates & Shapes
Bethlehem Steel Co.
Inland Steel Co.

Step Joints
See Joints, Step.

Switches
Bethlehem Steel Co.
Buda Company
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Switchmen's Houses
Massey Concrete Products Corp.

Switchpoint Protector
Maintenance Equipment Co.

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Bethlehem Steel Co.
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Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Tampers, Tie
See Tie Tampers

Tank Fixtures
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Tapes
Lufkin Rule Co.

Tee Rails
See Rails, Tee.

Telegraph Poles
See Poles

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International Creosoting & Construction Co.

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Tools, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Tools, Pneumatic
Ingersoll-Rand Co.

Tools, Track
Buda Co.
Q & C Co.
Verona Tool Works
Warren Tool & Forge Co.
Woodings Forge & Tool Co.

Tongue Switches
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. Co., Wm.

Torches, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Track Drills
See Drills, Track

Track Gages
Bethlehem Steel Co.
Buda Co.
Kalamazoo Railway Supply Co.

Track Jacks
See Jacks, Track

Track Liners
See Liners, Track

Track, Portable
Western Wheeled Scraper Co.

Track Tools
See Tools, Track

Transfer Tables
Industrial Works

Treating Plants, Water
American Water Softener Co.

Trestle Slabs
Massey Concrete Products Corp.

Tunnel Warnings
Hastings Signal & Equipment Co.

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Layne & Bowler Mfg. Co.

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Barber Asphalt Co.
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Chipman Chemical Engineering Co., Inc.

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Oxweld Railroad Service Co.

Welding & Cutting Equipment
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Well Systems
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Buda Co.
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Mudge & Co.
Northwestern Motor Co.
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Windshields
Mudge & Co.
Fairbanks, Morse & Co.

Wire
Interstate Iron & Steel Co.

Wire Fencing
Cyclone Fence Co.

Wood Grapples
Industrial Works

Wood Preservation
See Preservation, Timber

Woodworking Machinery
American Saw Mill Machinery Co.

Wrecking Cranes
Industrial Cranes

ALPHABETICAL INDEX TO ADVERTISERS

A
American Casting Co. 41
American Cast Iron Pipe Co. 49
American Chain Co. 44
American Saw Mill Machinery Co. 52
American Water Softener Co. 50
American Well Works, The 33
Armco Culvert & Flume Mfrs. Ass'n 13

B
Bethlehem Steel Co. 49
Buda Company 31
Barber Asphalt Co. 52

C
Cast Iron Pipe Publicity Bureau, The 32
Chipman Chemical Engineering Co. Inc. 39
Clark Car Co. 34
Cyclone Fence Co. 44

D
Dixon Crucible Co., Jos. 51
Du Pont de Nemours & Co., Inc., E.I. 28

E
Electric Tamper & Equipment Co. 11
Euclid Electric & Mfg. Co. 52

F
Fairbanks, Morse & Co. 19-20
Fairmont Railway Motors, Inc. 5
Federal Cement Tile Co. 35

G
Gardner Governor Co. 36

H
Hackmann Railway Supply Co. 29
Hastings Signal & Equipment Co. 48

I
Ingersoll-Rand Co. 16
Inland Steel Co. 14
International Creosoting & Const. Co. 22
Interstate Iron & Steel Co. 9
Industrial Works 55

J
Jordan Co., O. F. 45

K
Kalamazoo Railway Supply Co. 8
Kentucky Rock Asphalt Co. 50
Koppel Industrial Car & Equip. Co. 47

L
Lehon Co. 53
Long & Sons Co., E. M. 40
Lufkin Rule Co. 48
Lundie Engineering Corp. 37
Layne & Bowler Mfg. Co. 42

M
McMyler Interstate Co. 27
Magor Car Corp. 48
Maintenance Equipment Co. 42
Massey Concrete Prod. Corp. 12
Mechanical Mfg. Co. 46
Mudge & Co. 3
Midland Steel Products Co. 50
Murdock Mfg. & Supply Co. 51

N
National Lock Washer Co. 57
North American Cement Corp. 24
Northwestern Motor Co. 25

O
Owen Bucket Co. 15
Oxweld Railroad Service Co. 30

P
P. & M. Co. 1
Parsons Co. 23
Pease Co., C. F. 51

Q
Q. & C. Co. 6-7

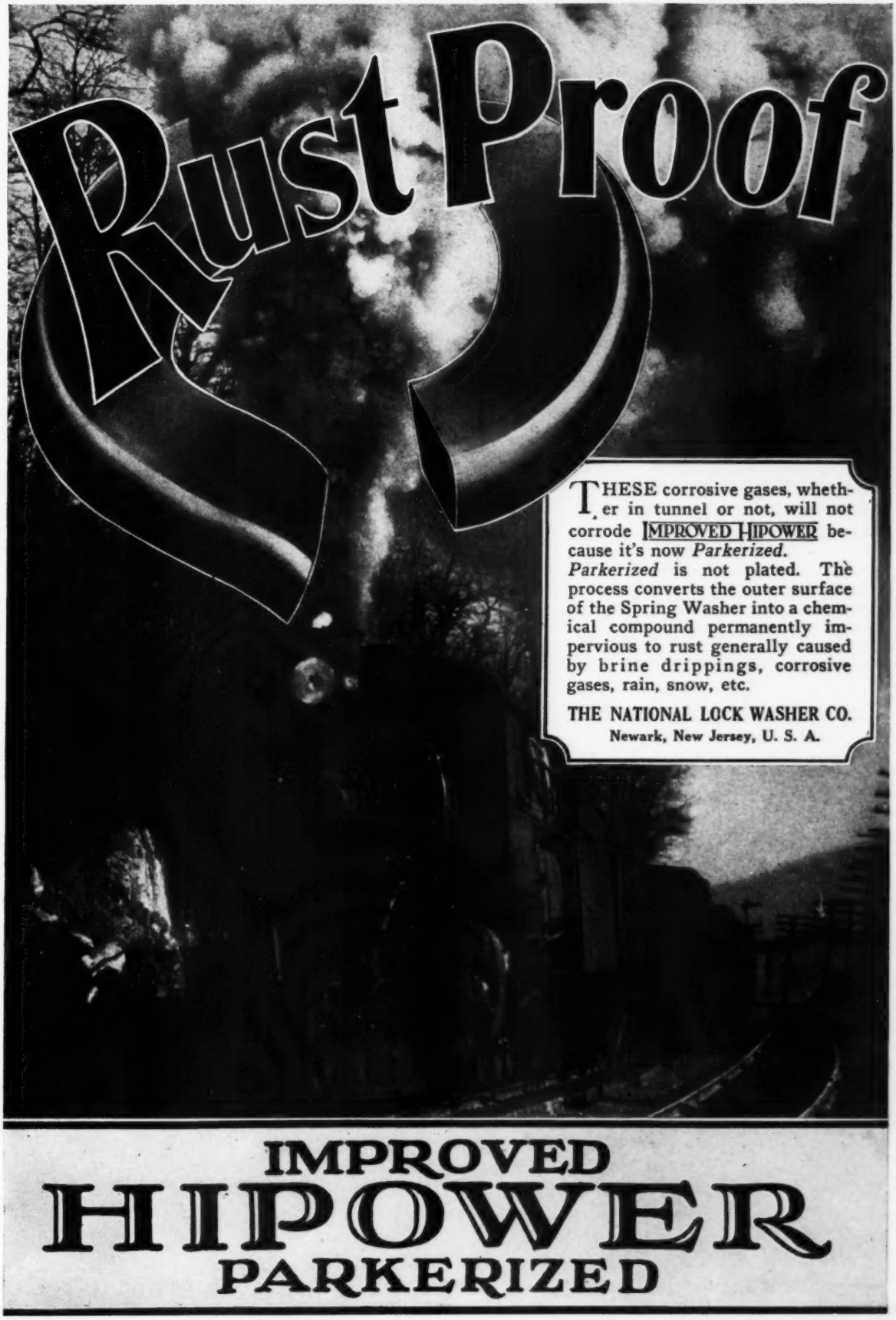
R
R. C. Products Co., Inc. 21
Rail Joint Co. 26
Railroad Accessories Corp. 38
Ramapo Ajax Corp. 18
Reliance Mfg. Co. 2
Royal Blue Bed Spring Co. 47

S
Simmons-Boardman Publ. Co. 40-43-53
Sullivan Machinery Co. 53

U
Universal Generator Co. 52

V
Verona Tool Works Co. 58

W
Warren Tool & Forge Co. 10
Western Wheeled Scraper Co. 17
Wharton, Jr., & Co., Wm. 51
Woodings Forge & Tool Co. 46
Woolery Machine Co. 45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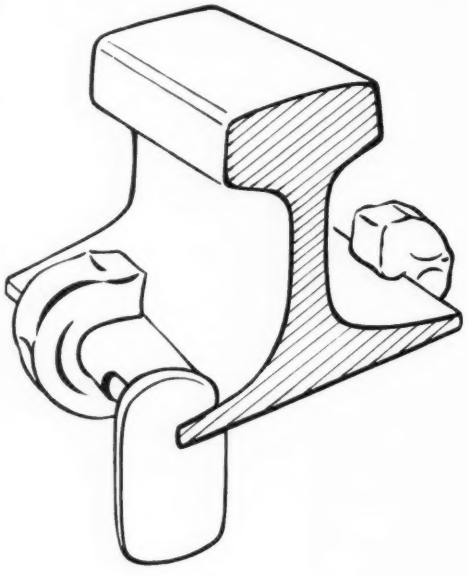

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